EPA/ROD/R08-91/047
1991

EPA Superfund
Record of Decision:

CHEMICAL SALES CO.
EPA ID: COD007431620
OU 03
DENVER, CO
06/27/1991

Text:

RESIDENTIAL EXPOSURE TO CONTAMINATED GROUNDWATER

#SBP
STATEMENT OF BASIS AND PURPOSE

THIS DECISION DOCUMENT PRESENTS THE SELECTED REMEDIAL ACTION FOR THE CHEMICAL SALES COMPANY (CSC) SITE, OPERABLE UNIT (OU) 3 LOCATED IN ADAMS COUNTY, COLORADO.

THIS REMEDY WAS CHOSEN IN ACCORDANCE WITH THE COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION AND LIABILITY ACT OF 1980 (CERCLA), AS AMENDED BY THE SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1989 (SARA) AND THE NATIONAL OIL AND HAZARDOUS SUBSTANCES POLLUTION CONTINGENCY PLAN (NCP).

THIS DECISION DOCUMENT EXPLAINS THE BASIS FOR SELECTING THE REMEDY FOR THIS OU. THE INFORMATION THAT FORMS THE BASIS OF THIS REMEDIAL ACTION DECISION IS CONTAINED IN THE ADMINISTRATIVE RECORD FOR THIS SITE AND IS SUMMARIZED IN THE ATTACHED DECISION SUMMARY.

THE STATE OF COLORADO CONCURS WITH THE SELECTED REMEDY FOR OU3.

ASSESSMENT OF THE SITE

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM THIS SITE, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS RECORD OF DECISION (ROD), MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE, OR THE ENVIRONMENT.

DESCRIPTION OF SELECTED REMEDY

THE CSC SITE HAS BEEN DIVIDED INTO THREE OPERABLE UNITS: LEYDEN ST. LOCATION (OU1); VOLATILE ORGANIC COMPOUND (VOC) GROUNDWATER CONTAMINATION NORTH OF SAND CREEK (OU2); AND RESIDENTIAL EXPOSURE TO CONTAMINATED GROUND WATER (OU3). CONTAMINATED SOIL LOCATED ON THE CSC PROPERTY AND GROUNDWATER CONTAMINATION LOCATED SOUTH OF SAND CREEK MAKE UP THE AREA KNOWN AS OU1. REMEDIAL ACTION OBJECTIVES FOR OU1 INCLUDE THE CONTROL OF MIGRATION OF CONTAMINATED GROUND WATER FROM OU1 INTO OU2. A SEPARATE ROD WILL BE PREPARED FOR THE REMEDIATION OF OU1. THE SELECTED REMEDY PRESENTED IN THE ROD FOR OU2 ADDRESSES GROUND WATER THAT HAS BEEN CONTAMINTED BY SOURCES WITHIN AND OUTSIDE OF OU2. THE REMEDY ADDRESSES BOTH THE TETRACHLOROETHYLENE (PCE) PLUME WHICH ORIGINATES IN THE VICINITY OF 56TH AVENUE AND QUEBEC STREET AND A RESIDUAL PLUME COMPRISED OF SEVERAL VOLATILE ORGANIC COMPOUNDS SEVERAL VOLATILE ORGANIC COMPOUNDS, PRIMARILY TRICHLOROETHYLENE (TCE) WHOSE SOURCE IS PRIMARILY THE CSC PROPERTY (OU1). THE ROD SUMMARIES FOR BOTH OU2 AND OU3 HAVE BEEN INCORPORATED INTO ONE DOCUMENT. THIS DOCUMENT IS ATTACHED TO THIS DECLARATION STATEMENT.

THE SELECTED REMEDY FOR OU3 ADDRESSES RESIDENTIAL EXPOSURE TO CONTAMINATED GROUND WATER THROUGH USE OF PRIVATE ALLUVIAL WELLS. THE MAJOR COMPONENTS OF THE SELECTED REMEDY FOR OU3 INCLUDE;

* CONNECTION OF PRIVATE ALLUVIAL WELL USERS TO THE SACWSD WATER SYSTEM;

* FOR RESIDENCES LOCATED IN RURAL AREAS WITHOUT REASONABLE ACCESS TO SACWSD WATER LINES PROVISION OF INDIVIDUAL HOME ACTIVATED TREATMENT UNITS; AND

* NOTIFICATION OF POTENTIAL HEALTH RISKS ASSOCIATED WITH

CONTAMINATED GROUND WATER, UPON REQUEST FOR AN ALLUVIAL WELL PERMIT WITHIN THE CSC SITE.

STATUTORY DETERMINATIONS

THE SELECTED REMEDY FOR OU3 IS PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT, COMPLIES WITH FEDERAL AND STATE REQUIREMENTS THAT ARE LEGALLY APPLICABLE OR RELEVANT AND APPROPRIATE TO THE REMEDIAL ACTION, AND ARE COST-EFFECTIVE. THESE REMEDIES UTILIZE PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. NO PRINCIPAL THREAT EXISTS FOR OU3.

JAMES J. SCHERER
REGIONAL ADMINISTRATOR
EPA REGION VIII

DATE: JUNE 27, 1991

#SNLD

I. SITE NAME, LOCATION, AND DESCRIPTION

THE CHEMICAL SALES COMPANY (CSC) SUPERFUND SITE IS LOCATED IN COMMERCE CITY AND IN NORTH DENVER, COLORADO, APPROXIMATELY FIVE MILES NORTHEAST OF DOWNTOWN DENVER, COLORADO. THE SITE IS DIVIDED INTO THREE OPERABLE UNITS, OPERABLE UNIT NO. 1 (OU1) AND OPERABLE UNIT NO. 2 (OU2), WHICH ARE SEPARATED BY SAND CREEK (SEE FIGURE 1), AND OPERABLE UNIT NO. 3 (OU3), WHICH ADDRESSES RESIDENTIAL EXPOSURE TO CONTAMINATED GROUND WATER THROUGH USE OF PRIVATE ALLUVIAL WELLS. OU1 INVESTIGATIONS ADDRESS SOURCE CONTROL/SOURCE REMOVAL OF CONTAMINATION IDENTIFIED ON, ADJACENT TO, AND DOWNGRADIENT OF THE CSC FACILITY, AND OU2 INVESTIGATIONS ADDRESS VOC GROUNDWATER CONTAMINATION NORTH OF SAND CREEK. THE SUBJECT OF THIS DECISION SUMMARY IS OU2 AND OU3. OU2 ADDRESSES VOLATILE ORGANIC COMPOUND GROUNDWATER CONTAMINATION NORTH OF SAND CREEK. OU3 ADDRESSES RESIDENTIAL EXPOSURE TO CONTAMINATED GROUND WATER WITHIN THE OU2 AREA.

OU2 IS LOCATED NORTH AND HYDROGEOLOGICALLY DOWNGRADIENT OF OU1, EXTENDING FROM QUEBEC STREET TO THE EAST, HOLLY STREET TO THE WEST, SAND CREEK TO THE SOUTH, AND EAST 86TH AVENUE TO THE NORTH (FIGURE 1). THESE BOUNDARIES HAVE BEEN DEFINED BY THE APPROXIMATE EXTENT OF VOLATILE ORGANIC GROUNDWATER CONTAMINATION EXTENDING NORTHWARD FROM SAND CREEK. EXISTING AND POTENTIAL RESIDENTIAL EXPOSURE ADDRESSED IN OU3 OCCURS THROUGH USE OF PRIVATE ALLUVIAL WELLS IN OU2. FIGURE 2 DESCRIBES THE LOCATION OF RESIDENCES THAT ARE DEPENDANT ON PRIVATE ALLUVIAL WELLS AS THEIR SOLE SOURCE OF WATER FOR INDOOR USE. OU2 AND OU3 ARE LOCATED WITHIN ADAMS COUNTY, COLORADO, AND ARE MOSTLY CONTAINED WITHIN COMMERCE CITY. A REMEDIAL INVESTIGATION (RI) AND FEASIBILITY STUDY (FS) WERE INITIATED BY EPA FOR OU2 IN JUNE 1989. THE OU3 FS WAS INITIATED IN JANUARY 1991. SITE CHARACTERIZATION DATA USED FOR THE OU3 FS WERE BASED ON INFORMATION COLLECTED FOR THE OU2 RI.

CONTAMINATED SOIL LOCATED ON AND ADJACENT TO THE CSC PROPERTY AND GROUNDWATER CONTAMINATION LOCATED SOUTH OF SAND CREEK MAKE UP THE AREA KNOWN AS OU1. OU1 IS ALSO KNOWN AS THE LEYDEN STREET LOCATION. IT IS APPROXIMATELY BOUNDED BY FOREST STREET TO THE WEST, I-70 TO THE SOUTH, QUEBEC STREET TO THE EAST, AND SAND CREEK TO THE NORTH. THE CSC SITE WAS FIRST DEVELOPED IN 1962 WHEN A WAREHOUSE WAS CONSTRUCTED ON THE PROPERTY. CSC PURCHASED THE PROPERTY IN 1976 AND BEGAN INSTALLING BOTH ABOVE AND BELOW GROUND CHEMICAL STORAGE TANKS RANGING IN SIZE FROM 5,000 TO 15,000 GALLONS AND CONTAINING A VARIETY OF ORGANIC CHEMICALS AND ACIDS. THE CSC FACILITY HAS BEEN IDENTIFIED AS A SOURCE OF CONTAMINATION TO GROUND WATER IN OU2 AS A RESULT OF BOTH DOCUMENTED AND UNDOCUMENTED SPILLS RELATED TO HANDLING AND STORAGE OF CHEMICALS. A RI/FS HAS BEEN CONDUCTED FOR THE OU1 SITE BY THE CHEMICAL SALES COMPANY

UNDER AN EPA ADMINISTRATIVE ORDER ON CONSENT (CERCLA-VIII-90-03, SIGNED SEPTEMBER 29, 1989).

CSC OU2 AND OU3 COMPRISE APPROXIMATELY FOUR SQUARE MILES AND CONSIST OF SINGLE AND MULTI-FAMILY RESIDENCES, SMALL BUSINESSES, AND MUNICIPAL FACILITIES. SEVERAL TRUCK TRANSPORT OPERATIONS AND LIGHT INDUSTRIAL FACILITIES ARE LOCATED IN THE SOUTHERN PART OF THE STUDY AREA. THE NORTHERN PART OF THE STUDY AREA CONTAINS AREAS OF IRRIGATED AGRICULTURAL LAND AND UNDEVELOPED LAND. THE SITE IS UNDERLAIN BY AN ALLUVIAL AQUIFER WHICH SERVES AS A MAJOR WATER SUPPLY.

CSC OU2 AND OU3 ARE LOCATED IN THE PIEDMONT, AT THE JUNCTURE OF THE ROCKY MOUNTAIN AND HIGH PLAINS PHYSIOGRAPHIC PROVINCES. THE STUDY AREA FOR THESE OPERABLE UNITS IS CONTAINED WITHIN THE SOUTH PLATTE RIVER BASIN. THE TOPOGRAPHY IS CHARACTERIZED BY LOW RELIEF WITH ELEVATIONS RANGING FROM APPROXIMATELY 5,200 FEET AT SAND CREEK AT THE SOUTHERN END OF THE STUDY AREA TO 5,120 FEET AT THE NORTHWEST CORNER OF THE STUDY AREA.

EXTENSIVE GROUNDWATER CONTAMINATION BY VOCS HAS BEEN OBSERVED IN THE SHALLOW ALLUVIAL AQUIFER BENEATH THE SITE. MOST OF THE SACWSD MUNICIPAL WATER SUPPLY IS DEVELOPED FROM THIS AQUIFER. THE SACWSD SUPPLIES ABOUT 30,000 CUSTOMERS WITH WATER DERIVED FROM WELLS. A TOTAL OF SIX ALLUVIAL AQUIFER PRODUCTION WELLS ARE CURRENTLY IN USE WITHIN OU2. ALL OF THESE WELLS EXCEPT ONE, SACWSD WELL NO. 18, ARE TREATED THROUGH ACTIVATED CARBON AT A PERMANENT TREATMENT FACILITY SELECTED VIA THE EPA OFF-POST ROCKY MOUNTAIN ARSENAL OU1 ROD.

#SHEA
II. SITE HISTORY AND ENFORCEMENT ACTIVITIES

THE HISTORY OF GROUNDWATER CONTAMINANT INVESTIGATIONS AND REMEDIATION WITHIN CSC OU2 AND THE SURROUNDING AREA IS VERY COMPLEX. THE FIRST CONTAMINANT STUDY IN THE AREA BEGAN IN THE 1950S, AND NUMEROUS STUDIES HAVE BEEN CONDUCTED SINCE 1980. BOUNDARIES OF THESE VARIOUS STUDIES HAVE OFTEN OVERLAPPED AND RESULTS FROM ONE INVESTIGATION HAVE OFTEN LED TO THE INITIATION OF ANOTHER. COMMERCE CITY AND ADJACENT AREAS GREW IN RESPONSE TO THE RAPID POST-WAR PROLIFERATION OF INDUSTRY NORTH AND EAST OF THE CITY OF DENVER. A SPECIAL GOVERNMENTAL DISTRICT, SACWSD WAS CREATED IN 1953 TO PROVIDE A WATER SUPPLY AND SEWAGE TREATMENT TO THE RESIDENTS AND BUSINESSES. THE SACWSD SUPPLIES APPROXIMATELY 30,000 CUSTOMERS WITH WATER FROM WELLS COMPLETED IN ALLUVIUM AND BEDROCK. APPROXIMATELY 85 PERCENT OF ITS WATER SUPPLY IS DERIVED FROM THE ALLUVIAL AQUIFER. A TOTAL OF SIX SACWSD ALLUVIAL PRODUCTION WELLS ARE CURRENTLY IN USE WITHIN THE CSC OU2 BOUNDARIES (SAC-14, 2, 3, 5, 17, AND 18).

IN 1981, EPA CONDUCTED A RANDOM NATIONAL SURVEY OF DRINKING WATER SYSTEMS. SEVERAL ORGANIC CHEMICALS WERE DETECTED IN SACWSD WELLS. ADDITIONAL SAMPLING IN 1982 AND 1985 CONFIRMED THESE RESULTS. AS A RESULT OF THESE FINDINGS, EPA BEGAN A RI/FS OF AN AREA CALLED "EPA'S OFF-POST ROCKY MOUNTAIN ARSENAL (RMA) OU1". THIS AREA WAS LARGER THAN CSC OU2, EXTENDING FROM SAND CREEK TO THE SOUTH, EAST 80TH AVENUE TO THE NORTH, AND FROM THE SOUTH PLATTE RIVER TO THE WEST TO THE WESTERN BORDER OF THE RMA TO THE EAST. THE RI/FS WAS COMPLETED IN DECEMBER 1986. THE RI RESULTS CONSISTENTLY INDICATED WIDESPREAD CONTAMINATION BY VOLATILE ORGANIC COMPOUNDS IN GROUND WATER ALONG THE EASTERN PORTION OF THE STUDY AREA. THE SELECTED ALTERNATIVE WAS A PERMANENT WATER TREATMENT SYSTEM FOR SACWSD WATER. THIS SYSTEM, THE KLEIN WATER TREATMENT PLANT, BEGAN OPERATING IN OCTOBER 1989. IT IS LOCATED NEAR THE SACWSD MUNICIPAL WATER SUPPLY CENTER AT EAST 77TH AVENUE AND QUEBEC STREET. THE PURPOSE OF THE KLEIN WATER TREATMENT PLANT IS TO TREAT CONTAMINATED ALLUVIAL GROUND WATER PRIOR TO DISTRIBUTION TO THE COMMUNITY, THEREBY PROTECTING THE HEALTH OF MUNICIPAL WATER SUPPLY USERS. THE MAJORITY OF RESIDENTS

IN THE AREA ARE PROVIDED WITH TREATED WATER FROM THE KLEIN WATER TREATMENT PLANT. CONCURRENT WITH THE RI/FS IN 1986, SOME 400 RESIDENTS USING PRIVATE WELLS WERE CONNECTED TO THE SACWSD MUNICIPAL WATER SUPPLY UNDER AN EPA REMOVAL ACTION.

FOLLOWING COMPLETION OF THE RI/FS FOR EPA'S OFF-POST RMA OU1, A SECOND OU WAS DEFINED WITH SLIGHTLY DIFFERENT BOUNDARIES. ADDITIONAL GROUNDWATER SAMPLING WAS CONDUCTED IN 1987 AS PART OF THIS CONTINUING INVESTIGATION. MORE WELLS WERE INSTALLED IN 1988 AND ADDITIONAL GROUNDWATER SAMPLING WAS UNDERTAKEN.

THE ADJACENT RMA WAS SUSPECTED AS ONE OF THE POTENTIAL SOURCES OF CONTAMINANTS IN THE EPA'S OFF-POST ROCKY MOUNTAIN ARSENAL STUDY AREA BECAUSE OF THE HISTORY OF WASTE DISPOSAL PRACTICES ON THAT SITE. FURTHER INVESTIGATION BY EPA'S FIELD INVESTIGATION TEAM (FIT) INDICATED THAT ADDITIONAL SOURCE AREAS WERE POTENTIALLY CONTRIBUTING TO GROUNDWATER CONTAMINATION DETECTED WITHIN THE STUDY AREA. AN EPA SOIL GAS SURVEY CONDUCTED IN APRIL 1986 OF AN AREA NEAR 48TH AVENUE AND LEYDEN STREET INDICATED ELEVATED TCE ION FLUX VALUES IN THE VICINITY OF THE CSC FACILITY. GROUNDWATER INVESTIGATIONS WERE ALSO UNDERTAKEN BY EPA IN AUGUST/SEPTEMBER 1986 AT 48TH AVENUE AND LEYDEN STREET AND AT EAST 50TH AVENUE AND IVY STREET, AND REVEALED THE PRESENCE OF VOLATILE ORGANIC CONTAMINANTS IN THE VICINITY OF THE CSC FACILITY. A SOIL GAS SURVEY CONDUCTED BY THE CHEMICAL SALES COMPANY IN AUGUST 1987 CONFIRMED THE PRESENCE OF TCE AND OTHER CHLORINATED HYDROCARBONS NEAR THE CSC FACILITY. GROUNDWATER MONITORING WELLS INSTALLED ON THE CSC PROPERTY HAVE SINCE CONFIRMED CSC AS A SOURCE OF GROUNDWATER CONTAMINATION.

BASED ON THE ADDITIONAL WORK BY EPA TO DEFINE SOURCE AREAS, THE CSC SITE WAS PROPOSED FOR LISTING ON THE NATIONAL PRIORITIES LIST (NPL) IN JUNE 1988. RESPONSIBILITY FOR THE RI/FS WAS THEN TRANSFERRED FROM THE EPA OFF-POST ROCKY MOUNTAIN ARSENAL STUDY AREA TO THE CSC SITE STUDIES. THE LISTING WAS MADE FINAL IN AUGUST 1990.

ON AUGUST 1, 1989, EPA ISSUED CSC A SPECIAL NOTICE LETTER REQUESTING CSC TO CONDUCT AN RI/FS FOR THE ENTIRE CSC SITE. CSC NOTIFIED EPA THAT THE COMPANY WOULD ELECT NOT TO CONDUCT AN RI/FS FOR THE ENTIRE CSC SITE. IN JUNE 1989, EPA SUBDIVIDED THE GROUNDWATER RI/FS ACTIVITIES INTO TWO SEPARATE OUS FOR THE CSC SITE (OU1 AND OU2). AS A RESULT OF THIS SUBDIVISION, EPA INITIATED RI/FS ACTIVITIES FOR OU2 AND REQUESTED THAT CSC CONDUCT AN RI/FS FOR OU1. ON SEPTEMBER 9, 1989, EPA AND CSC ENTERED INTO AN ADMINISTRATIVE ORDER ON CONSENT REQUIRING CSC TO CONDUCT AN RI/FS FOR CSC OU1.

EPA INITIATED THE RI/FS FOR CSC OU2 IN JUNE 1989. THE OBJECTIVES OF THE RI WERE TO:

* IDENTIFY THE NATURE AND EXTENT OF GROUNDWATER CONTAMINATION AT THE SITE;

* IDENTIFY EXISTING AND POTENTIAL RECEPTORS OF THE CONTAMINATION;

* ASSESS THE POTENTIAL RISKS TO PUBLIC HEALTH AND THE ENVIRONMENT; AND

* EVALUATE POTENTIAL CONTAMINANT SOURCES IMPACTING THE OU2 AREA.

TO MEET THESE OBJECTIVES, SOIL BORINGS WERE DRILLED, A COMPREHENSIVE SAMPLING OF MONITORING OF PRIVATE WELLS WAS UNDERTAKEN, A RISK ASSESSMENT WAS PERFORMED, A LABORATORY INVESTIGATION OF THE FATE AND TRANSPORT OF THE CONTAMINANTS WAS CONDUCTED, AND A GROUNDWATER FLOW AND TRANSPORT MODEL WAS DEVELOPED. THE FS WAS THEN CONDUCTED TO DEVELOP AND

EVALUATE REMEDIAL ALTERNATIVES THAT WOULD EFFECTIVELY MINIMIZE THE THREAT TO, AND PROVIDE ADEQUATE PROTECTION OF, PUBLIC HEALTH AND THE ENVIRONMENT FROM CONTAMINATED GROUND WATER IN OU2.

IN ORDER TO ASSESS EXISTING AND POTENTIAL RECEPTORS TO THE OBSERVED GROUNDWATER CONTAMINATION, A STUDY WAS CONDUCTED BY THE COLORADO DEPARTMENT OF HEALTH AND TRI-COUNTY HEALTH DEPARTMENT TO DETERMINE THE WATER SOURCE OF RESIDENTS POTENTIALLY AT RISK FROM EXPOSURE TO CONTAMINATED GROUND WATER. RESULTS OF THIS SURVEY INDICATE THAT 12 KNOWN RESIDENTS WITHIN THE CSC OU2 AREA ARE SOLELY DEPENDANT ON DOMESTIC ALLUVIAL WELLS FOR THEIR PRINCIPAL SOURCE OF WATER. IN ADDITION, TRI-COUNTY HEALTH DEPARTMENT, UNDER DIRECTION OF EPA, CONDUCTED A SIMILAR SURVEY WITHIN CSC OU1. ALTHOUGH MANY RESIDENTS WITHIN THE OU1 AREA HAD DOMESTIC WELLS LOCATED ON THEIR PROPERTY, ALL RESIDENTS WITHIN OU1 WERE PROVIDED TREATED WATER FROM THE SACWSD SYSTEM.

THE NEAREST UNTREATED SACWSD WELL TO THE SACWSD PUMPING CENTER AT 77TH AVENUE AND QUEBEC STREET IS WELL 18, LOCATED NORTH OF THE SACWSD PUMPING CENTER (FIGURE 2). SOME ORGANIC COMPOUNDS, MOST NOTABLY TCE, HAVE BEEN DETECTED SPORADICALLY IN THIS WELL. THE MAXIMUM CONCENTRATION OF TCE THAT HAS BEEN DETECTED IN WELL 18 IS 12 UG/L. AVERAGE CONCENTRATIONS OF TCE RANGE FROM APPROXIMATELY 4 UG/L TO 6 UG/L. ALTHOUGH CONCENTRATIONS OF TCE FLUCTUATE DRAMATICALLY, THERE APPEARS TO BE AN UPWARD TREND IN CONCENTRATION. WELL 18 IS NOT CONNECTED TO THE KLEIN WATER TREATMENT PLANT, AND IT IS ALWAYS BLENDED WITH WATER THAT HAS BEEN TREATED AT THE PLANT BEFORE IT IS PUT INTO THE SACWSD DISTRIBUTION SYSTEM. ASSUMING AN AVERAGE TCE CONCENTRATION OF 3 UG/L FROM THE KLEIN WATER TREATMENT FACILITY EFFLUENT, THE MAXIMUM CONCENTRATION OF TCE THAT CAN BE TOLERATED IN WELL NO. 18 IS 5.7 UG/L IN ORDER NOT TO EXCEED THE MCLS. WELL 18 IS LOCATED DOWN GRADIENT OF THE OTHER SACWSD SUPPLY WELLS. THE PRESENCE OF VOCS IN WELL 18 WATER IMPLIES THAT EITHER THE CURRENT SACWSD MUNICIPAL SUPPLY WELLS ARE NOT CAPTURING THE ENTIRE PLUME OR THE CONTAMINATION IS MIGRATING TO WELL 18 FROM OTHER PARTS OF THE AQUIFER. WHILE REMEDIATION OF WELL 18 IS NOT CONTEMPLATED AT THIS TIME, EPA WILL EVALUATE ADDITIONAL DATA SUBSEQUENT TO ISSUANCE OF THE RODS FOR THE SITE, AND IF NECESSARY, IDENTIFY AND EVALUATE ALTERNATIVES TO ADDRESS WELL 18 GROUND WATER CONTAMINATION.

#HCI
III. HIGHLIGHTS OF COMMUNITY INVOLVEMENT

COMMUNITY INTEREST IN GROUNDWATER CONTAMINATION IN SOUTH ADAMS COUNTY WAS VERY INTENSE IN 1985 AND EARLY 1986 WHEN THE PROBLEM FIRST BECAME PUBLIC. INITIALLY THE ROCKY MOUNTAIN ARSENAL, WHICH IS ADJACENT TO THE CONTAMINATED PUBLIC WATER SUPPLY AREA AND ALREADY RECEIVING SIGNIFICANT MEDIA ATTENTION, WAS THOUGHT TO BE THE SOURCE. LOCAL CITIZENS FORMED A VERY VOCAL GROUP, CITIZENS AGAINST CONTAMINATION (CAC), WHICH HELD A NUMBER OF WELL ATTENDED PUBLIC MEETINGS (OVER 600 PEOPLE ATTENDED THE MARCH 6, 1986 MEETING). CAC KEPT THE ISSUE IN THE PRESS AND IN THE ATTENTION OF LOCAL, STATE, AND FEDERAL POLITICIANS. EPA AND THE ARMY RESPONDED TO NUMEROUS PUBLIC AND MEDIA INQUIRIES, ISSUED PRESS RELEASES FOR NEW DEVELOPMENTS, AND ATTENDED THE PUBLIC MEETINGS. COMMUNITY RELATIONS ACTIVITIES WERE COORDINATED AMONG THE EPA, THE ARMY, AND THE SACWSD. THE STATE CONDUCTED A SEPARATE PROGRAM.

PUBLIC INTEREST SUBSIDED IN MID-1986 AFTER A TEMPORARY WATER TREATMENT SYSTEM FUNDED BY THE ARMY AND THE EPA CAME INTO OPERATION AT SACWSD AND TREATED WATER WAS THUS MADE AVAILABLE TO THE AFFECTED RESIDENCES. IN THE FALL OF 1986, EPA NAMED THE CHEMICAL SALES SITE AS A SOURCE OF GROUNDWATER CONTAMINATION. EPA HAS SINCE ISSUED A NUMBER OF FACT SHEETS DISCUSSING THE PROGRESS OF THE INVESTIGATION AND ACTIVITIES AT THE SITE. THE CHEMICAL SALES SITE WAS ALSO INCLUDED IN JOINT COMMUNITY RELATIONS

ACTIVITIES WITH SEVERAL OTHER SOUTH ADAMS COUNTY SUPERFUND SITES.

THE PROPOSED PLAN FOR OU2 WAS ISSUED TO THE PUBLIC CONCURRENTLY WITH PROPOSED PLANS FOR OU1 AND OU3 ON FEBRUARY 25, 1991. THE PROPOSED PLAN AND RI/FS REPORTS WERE MADE AVAILABLE TO THE PUBLIC IN THE ADMINISTRATIVE RECORD MAINTAINED AT THE EPA REGION VIII SUPERFUND RECORDS CENTER IN DENVER, COLORADO. A NOTICE OF AVAILABILITY FOR THESE DOCUMENTS WAS PUBLISHED IN THE DENVER POST AND ROCKY MOUNTAIN NEWS ON FEBRUARY 28, 1991; IN THE COMMERCE CITY BEACON ON FEBRUARY 27, 1991; AND IN THE COMMERCE CITY EXPRESS ON MARCH 5, 1991. THE PUBLIC COMMENT PERIOD WAS OPEN FROM FEBRUARY 28 TO APRIL 1, 1991. THE PUBLIC MEETING WAS HELD MARCH 14, 1991 AT THE COMMERCE CITY RECREATION CENTER AND WAS ATTENDED BY 50-75 PEOPLE. A TRANSCRIPT OF THE PUBLIC MEETING IS INCLUDED IN THE ADMINISTRATIVE RECORD. AT THIS MEETING, EPA REPRESENTATIVES ANSWERED QUESTIONS ABOUT THE SITE AND DISCUSSED THE REMEDIAL ALTERNATIVES UNDER CONSIDERATION. DETAILS OF COMMUNITY INVOLVEMENT THROUGHOUT THE RI/FS ARE INCLUDED IN THE RESPONSIVENESS SUMMARY SECTION OF THIS ROD.

IN ADDITION, RESPONSES TO COMMENTS RECEIVED DURING THE PUBIC COMMENT PERIOD ON THE PROPOSED PLAN ARE PRESENTED IN THE RESPONSIVENESS SUMMARY.

#SROU
IV. SCOPE AND ROLE OF OPERABLE UNITS WITHIN SITE STRATEGY

THE CSC SITE HAS BEEN DIVIDED INTO THREE OPERABLE UNITS: OU1, WHICH ADDRESSES CONTAMINATED SOIL LOCATED ON AND ADJACENT TO THE CSC PROPERTY AND GROUNDWATER CONTAMINATION SOUTH OF SAND CREEK; OU2, THE SUBJECT OF THIS ROD, WHICH ADDRESSES GROUND WATER CONTAMINATION BY VOLATILE ORGANIC COMPOUNDS NORTH OF SAND CREEK; AND OU3, ALSO THE SUBJECT OF THIS ROD, WHICH ADDRESSES EXPOSURE TO CONTAMINATED GROUND WATER THROUGH USE OF PRIVATE ALLUVIAL WELLS LOCATED WITHIN OU2. OU1 AND OU2 ARE SEPARATED BY SAND CREEK. OU2 IS LOCATED NORTH AND GENERALLY DOWN GRADIENT OF OU1. THE BOUNDARIES OF OU2 HAVE BEEN DEFINED BY THE APPROXIMATE EXTENT OF GROUNDWATER CONTAMINATION NORTH OF SAND CREEK.

EPA IS SELECTING REMEDIES FOR OU1 CONCURRENTLY WITH THE REMEDIES FOR OU2 AND OU3. CONTAMINATED SOIL AND GROUND WATER WITHIN OU1 PROVIDE A MAJOR SOURCE OF CONTAMINATION TO GROUND WATER LOCATED IN OU2. THE PRINCIPAL RISK AT THE OU1 SITE IS INGESTION, DIRECT CONTACT AND INHALATION OF GROUNDWATER CONTAMINANTS AND DIRECT CONTACT AND INHALATION OF SOIL CONTAMINANTS. CONTAMINATED SOIL IS ALSO A PRINCIPAL SOURCE OF GROUNDWATER CONTAMINATION.

IT IS ASSUMED THAT SOURCE CONTROL OF CONTAMINATED GROUND WATER IN CSC OU1 WILL BE UNDERTAKEN AS PART OF THE REMEDIAL ACTIVITIES PLANNED FOR THE CSC OU1 SITE. REMEDIAL ACTION OBJECTIVES FOR THE CSC OU1 SITE ARE: 1) TO PREVENT THE MIGRATION OF CONTAMINATED GROUND WATER INTO CSC OU2; 2) TO RESTORE THE GROUND WATER IN CSC OU1 TO CONCENTRATIONS MEETING DRINKING WATER STANDARDS AND CARCINOGENIC RISK WITHIN (10-4) TO (10-6); 3) TO PREVENT CONTAMINANTS IN THE SOIL FROM LEACHING INTO GROUND WATER RESULTING IN THE NON-ATTAINMENT OF THE REMEDIAL ACTION OBJECTIVES FOR GROUND WATER; AND 4) PREVENT INHALATION, INGESTION AND DIRECT CONTACT WITH SOILS RESULTING IN A CANCER RISK IN EXCESS OF (10-6). SINCE OU2 IS LOCATED DIRECTLY DOWNGRADIENT OF OU1, SUCCESSFUL ATTAINMENT OF THESE OBJECTIVES WILL RESULT IN THE REDUCTION OF CONTAMINANT CONCENTRATIONS IN GROUND WATER WITHIN OU2.

THE OBJECTIVE OF OU2 IS TO RESTORE ALLUVIAL AQUIFER TO ACCEPTABLE CONTAMINANT LEVELS FOR INDOOR USE. OU2 ADDRESSES THE DOWNGRADIENT PORTION OF THE TCE GROUNDWATER PLUME AND THE ENTIRE PCE PLUME.

THE OBJECTIVE OF OU3 IS TO ENSURE THAT ALL RESIDENTS WITHIN THE CSC SITE ARE PROVIDED SUITABLE WATER FOR DOMESTIC PURPOSES. CURRENTLY, 12 PROPERTIES WITHIN THE OU2 SITE HAVE NOT BEEN CONNECTED TO THE SACWSD MUNICIPAL WATER SUPPLY SYSTEM AND RELY ON THEIR ALLUVIAL WELLS FOR INDOOR USE. THE PRIMARY FUNCTION OF THIS OPERABLE UNIT IS TO EVALUATE REMEDIAL ALTERNATIVES WHICH WILL REDUCE THE RISK POSED THROUGH RESIDENTIAL USE OF DOMESTIC WATER. REMEDIAL ALTERNATIVES EVALUATED UNDER OU3 WOULD REDUCE EXPOSURE TO CONTAMINATED GROUND WATER FOR RESIDENTS USING ALLUVIAL WELLS DURING THE TIME PERIOD REQUIRED TO REMEDIATE THE AQUIFER UNDERLYING OU1 AND OU2.

#SC
V. SITE CHARACTERISTICS

GEOLOGY

THE SITE IS LOCATED WITHIN THE DENVER BASIN, A STRUCTURAL DEPRESSION EXTENDING FROM THE FRONT RANGE EASTWARD TO THE KANSAS BORDER, AND FROM PUEBLO, COLORADO, NORTHWARD TO THE HARTVILLE UPLIFT OF WYOMING. AT LEAST 12,000 FEET OF SEDIMENTARY ROCKS OVERLIE PRECAMBRIAN BASEMENT ROCK WITHIN THE BASIN, WHICH HAS UNDERGONE EPISODES OF TECTONIC MOVEMENT THROUGHOUT GEOLOGIC TIME. THE BEDROCK STRATUM OF INTEREST IS THE DENVER FORMATION OF THE DAWSON GROUP, OF UPPER CRETACEOUS TO PALEOCENE AGE. THE BEDROCK STRATA ARE OVERLAIN BY UNCONSOLIDATED ALLUVIAL AND EOLIAN DEPOSITS OF VARIABLE THICKNESS.

THE DENVER FORMATION IS COMPRISED OF 600 TO 1,000 FEET OF INTERBEDDED SHALE, CLAYSTONE, SILTSTONE AND SANDSTONE, WITH ABUNDANT FOSSIL REMAINS AND COAL SEAMS. SURFICIAL DEPOSITS WHICH OVERLIE THE BEDROCK DENVER FORMATION IN THE VICINITY OF THE SITE CONSIST OF ALLUVIAL MATERIAL DEPOSITED BY THE SOUTH PLATTE RIVER SYSTEM AND WINDBLOWN SAND, SILT AND CLAY. THE THICKNESS OF THESE UNCONSOLIDATED DEPOSITS IS VARIABLE, RANGING FROM LESS THAN 10 FEET TO OVER 100 FEET IN SEVERAL PALEOCHANNEL FEATURES ERODED INTO THE UPPER SURFACE OF THE DENVER FORMATION BY THE ANCESTRAL SOUTH PLATTE RIVER AND ITS TRIBUTARIES. THE ENTIRE THICKNESS OF THE UNCONSOLIDATED SANDS, GRAVELS, SILTS, AND CLAYS IS CONSIDERED TO BE A SINGLE WATER-BEARING UNIT THROUGHOUT THE SITE. IN SOME AREAS, THE ALLUVIAL MATERIAL MAY BE HYDRAULICALLY CONNECTED WITH THE UNDERLYING DENVER FORMATION.

HYDROGEOLOGY

THE PRINCIPAL MIGRATION PATHWAY FOR THE ORGANIC CONTAMINANTS IS GROUNDWATER FLOW WITHIN THE ALLUVIAL AQUIFER. THIS AQUIFER IS THE PRIMARY DRINKING WATER SOURCE FOR AREA RESIDENTS VIA SACWSD MUNICIPAL WELLS. EXTENSIVE GROUNDWATER CONTAMINATION BY VOLATILE ORGANIC COMPOUNDS HAS BEEN OBSERVED IN THE ALLUVIUM.GROUND WATER IN THE ALLUVIAL AQUIFER BENEATH OU2 GENERALLY FLOWS NORTH TO NORTHWEST TOWARD THE SOUTH PLATTE RIVER (FIGURE 3). THE WATER TABLE IN OU2 VARIES FROM A FEW FEET BELOW GROUND SURFACE ADJACENT TO THE SOUTH PLATTE RIVER TO ABOUT 50 FEET BELOW GROUND SURFACE AT THE EASTERN BOUNDARY OF THE OU2 SITE. THE POTENTIOMETRIC SURFACE IS CHARACTERIZED BY A LOWER GRADIENT IN OU2 AND NEAR THE SOUTH PLATTE RIVER, AND A STEEPER GRADIENT SOUTH AND EAST OF OU2. THE POTENTIOMETRIC SURFACE CONFIGURATION IS INFLUENCED BY THE LOCATION OF BEDROCK PALEOCHANNELS (FIGURE 4) AND PUMPAGE OF SACWSD MUNICIPAL WELLS (FIGURE 2), THE RMA IRONDALE BOUNDARY SYSTEM AND TO A LESSER EXTENT, PRIVATE, COMMERCIAL, AND AGRICULTURAL WELLS.

GROUNDWATER FLOW CONVERGES IN THE VICINITY OF THE SACWSD PUMPING CENTER AT 77TH AVENUE AND QUEBEC STREET FROM SOUTHEAST TO SOUTHWEST, BECAUSE OF CONVERGENCE OF PALEOCHANNELS IN THIS AREA. THESE PALEOCHANNELS INFLUENCE THE MIGRATION OF CONTAMINANTS, AND ARE IMPORTANT WITH RESPECT

TO CONTAMINATION OF SACWSD MUNICIPAL WELLS, SINCE SEVERAL OF THE MUNICIPAL WELLS ARE LOCATED IN OR NEAR PALEOCHANNELS. THE VERTICAL HYDRAULIC GRADIENT WITHIN THE ALLUVIUM IS GENERALLY DOWNWARD. THE VERTICAL GRADIENT BETWEEN THE UNDERLYING BEDROCK AND THE ALLUVIUM VARIES FROM UPWARD TO DOWNWARD ACROSS THE SITE AND IS GENERALLY CONSIDERED TO BE INSIGNIFICANT IN MAGNITUDE.

THE SATURATED THICKNESS OF THE ALLUVIAL AQUIFER VARIES WIDELY FROM LOCALIZED UNSATURATED ZONES TO SATURATED THICKNESSES OF OVER SIXTY FEET. DEPTH TO THE SATURATED ZONE RANGES FROM A FEW FEET NEAR THE SOUTH PLATTE RIVER TO OVER FIFTY FEET FURTHER AWAY FROM THE RIVER (FIGURE 5). FLOW DOMINATES IN PALEOCHANNELS, WHICH CONTAIN LARGER SATURATED THICKNESSES AND SAND AND GRAVEL DEPOSITS WITH A RELATIVELY HIGHER HYDRAULIC CONDUCTIVITY.

THE SHALLOW ALLUVIAL AQUIFER IS HIGHLY TRANSMISSIVE. GROUNDWATER FLOW VELOCITY IS VARIABLE WITHIN CSC OU2 (APPROXIMATELY 5 TO 12 FEET/DAY), AND IS LOCALLY INFLUENCED BY THE HYDRAULIC GRADIENT, THE HYDRAULIC CONDUCTIVITY AND THE EFFECTIVE POROSITY OF THE AQUIFER. DEPENDING ON THESE FACTORS, TRAVEL TIME FROM EAST 48TH AVENUE TO THE SACWSD PUMPING CENTER RANGES FROM 4.8 TO 12.1 YEARS. ACTUAL CONTAMINANT VELOCITIES WILL BE LOWER DUE TO COMPOUND RETARDATION.

NATURE AND EXTENT OF CONTAMINATION

THE RESULTS OF THE CSC OU2 RI SHOWED EXTENSIVE GROUND WATER CONTAMINATION BY VOLATILE ORGANIC COMPOUNDS IN THE STUDY AREA. CONTAMINANTS WERE NOT DETECTED IN OTHER MEDIA. THE CHEMICALS OF CONCERN IN GROUND WATER ARE:

* 1,1-DICHLOROETHANE (DCA)
* 1,1-DICHLOROETHYLENE (DCE)
* TOTAL 1,2-DICHLOROETHYLENE (TOTAL 1,2-DCE) (THE SUM OF THE TRANS AND CIS ISOMERS)
* 1,1,1-TRICHLOROMETHANE (TCA)
* TRICHLOROETHYLENE (TCE)
* TETRACHLOROETHYLENE (PCE)
* BENZENE (BZ)
* VINYL CHLORIDE (VC)

THIS GROUP OF CONTAMINANTS IS GENERALLY MOBILE IN GROUND WATER. MOST OF THE COMPOUNDS ARE CENTRAL NERVOUS SYSTEM DEPRESSANTS AND EITHER LIVER OR KIDNEY TOXINS AT HIGH DOSES. SIX OF THE COMPOUNDS ARE KNOWN TO CAUSE CARCINOGENIC EFFECTS IN ANIMAL STUDIES, AND OF THE SIX, VINYL CHLORIDE AND BENZENE ARE CLASSIFIED BY EPA AS CLASS A - HUMAN CARCINOGENS.

MAXIMUM CONTAMINANT LEVELS (MCLS) OR PROPOSED MCLS WERE EXCEEDED FOR FIVE OF THE EIGHT COMPOUNDS OF CONCERN IN CSC OU2 WELLS DURING SAMPLING CONDUCTED IN OCTOBER 1989. THESE COMPOUNDS ARE PCE, TCE, DCA, DCE AND VC. IN GENERAL, CONCENTRATIONS OF CONTAMINANTS IN WELLS UPGRADIENT (SOUTH AND EAST) OF OU2 ARE HIGHER THAN CONCENTRATIONS IN WELLS WITHIN OU2. CONTAMINANT CONCENTRATIONS GENERALLY DECREASE FROM SOUTH TO NORTH WITHIN OU2. NORTH OF THE EAST 77TH AVENUE SACWSD PUMPING CENTER, MOST CONTAMINANT CONCENTRATIONS ARE BELOW THE MCLS. MAPS SHOWING THE DISTRIBUTIONS AND CONCENTRATIONS OF CONTAMINANTS AND DISCUSSIONS OF TEMPORAL TRENDS IN CONTAMINANTS MAY BE FOUND IN THE FINAL RI REPORT.

PCE CONTAMINATION IS PERVASIVE THROUGHOUT THE ALLUVIAL AQUIFER IN CSC OU2. MEAN 1989 CONCENTRATIONS RANGED FROM A HIGH OF 110 UG/L NORTH OF SAND CREEK NEAR 60TH AVENUE AND QUEBEC STREET TO LESS THAN 10 UG/L NEAR THE SACWSD PUMPING CENTER AT 77TH AVENUE AND QUEBEC STREET. HIGH CONCENTRATIONS OF PCE FOUND SOUTH OF 56TH AVENUE BETWEEN HOLLY AND MONACO STREETS WITHIN OU2 APPEAR TO BE DIRECTLY RELATED TO HIGH CONCENTRATIONS OF PCE FOUND SOUTH OF SAND CREEK WITHIN OU1. AN

UNIDENTIFIED SOURCE OF PCE CONTAMINATION IS BELIEVED TO BE PRESENT NEAR 56TH AVENUE AND QUEBEC STREET, WHERE RELATIVELY HIGH PCE CONCENTRATIONS HAVE ALSO BEEN IDENTIFIED IN GROUND WATER.

TCE CONTAMINATION IS ALSO WIDESPREAD IN CSC OU2. IN 1989, MEAN CONCENTRATIONS RANGED FROM BELOW DETECTION TO 53 UG/L WITHIN OU2. RELATIVELY HIGH CONCENTRATIONS (10-50 UG/L) ARE DISTRIBUTED FROM SAND CREEK TO THE SACWSD PUMPING CENTER.

THE TCE AND PCE GROUNDWATER DATA SUMMARIZED ABOVE WERE HAND-CONTOURED TO ILLUSTRATE THE MAJOR PLUMES OF GROUNDWATER CONTAMINATION IN CSC OU2. THESE PLUMES ARE PRESENTED IN FIGURES 6 AND 7. THE MAPS WERE DEVELOPED TO SHOW GENERAL TRENDS IN THE PRESENT CONTAMINANT DISTRIBUTION IN CSC OU2. POTENTIAL SOURCES AND TEMPORAL TRENDS WERE NOT CONSIDERED IN DEVELOPMENT OF THESE MAPS, AND AS SUCH, THEY CAN BE SUBJECT TO UNCERTAINTY AND OPEN TO OTHER INTERPRETATIONS.

A DISTINCT PLUME OF GROUNDWATER CONTAMINATION EMANATING FROM THE CSC FACILITY FLOWS NORTHWARD FROM OU1 INTO OU2. THIS PLUME IS CHARACTERIZED PRIMARILY BY RELATIVELY HIGH LEVELS OF TCE IN MEAN CONCENTRATIONS RANGING FROM GREATER THAN 50 UG/1 IN THE UPGRADIENT AREA (SOUTH OF SAND CREEK) TO BELOW DETECTION LIMITS IN DOWNGRADIENT AREAS WITHIN OU2. PCE, TCA, AND 1,2-DCE ALSO OCCUR WITHIN THE AREA OF THIS PLUME. THE AREAL DISTRIBUTION OF THESE CONTAMINANTS IS INDICATIVE OF A CONTINUOUS PLUME FROM THE CSC PROPERTY IN OU1 TO NORTH OF SAND CREEK IN OU2. CONCENTRATIONS DECREASE STEADILY DOWNGRADIENT OF THE CSC PROPERTY, WHICH IS BELIEVED TO BE DUE TO DILUTION, DISPERSION, ADSORPTION, AND BIODEGRADATION. THIS PLUME (REFERRED TO AS THE TCE PLUME) HAS MIGRATED NORTHWARD THROUGH MOST OF THE CSC OU2 SITE, AS SHOWN IN FIGURE 6. THE PRESENCE OF THE PLUME WAS DETECTED AS EARLY AS 1985, AND THE KLEIN WATER TREATMENT PLANT WAS CONSTRUCTED TO TREAT CONTAMINATED GROUND WATER THAT WAS EXTRACTED FROM THE AQUIFER BEFORE IT WAS ADDED TO THE MUNICIPAL WATER SYSTEM.

THE SECOND PLUME BEGINS AT APPROXIMATELY EAST 56TH AVENUE AND QUEBEC STREET (FIGURE 7), AND IS CHARACTERIZED PRIMARILY BY PCE, AT A MEAN CONCENTRATION OF UP TO 110 UG/L. MONITORING AT SACWSD MONITORING WELL 08, LOCATED ON THE NORTHWEST CORNER OF THE INTERSECTION OF 56TH AVENUE AND QUEBEC STREET, HAS SHOWN HIGH CONCENTRATIONS OF PCE. THE SOURCE OF THE PCE PLUME WAS NOT LOCATED IN CSC OU2 DURING THE RI. EPA FIELD INVESTIGATION TEAM (FIT) INVESTIGATIONS WERE CONDUCTED UP-GRADIENT OF MONITORING WELL 08 ON THE DENVER ENGINEERING OPERATIONS CENTER (DEOC) PROPERTY TO THE SOUTHEAST OF 56TH AVENUE AND QUEBEC STREET. MONITORING WELLS WERE INSTALLED AND A SOIL GAS SURVEY WAS PERFORMED, BUT THE PCE SOURCE WAS NOT FOUND. RESULTS OF THE CSC OU2 RI AND THE FIT INVESTIGATIONS INDICATED THAT ANOTHER POTENTIAL SOURCE AREA FOR THE PCE PLUME MAY BE LOCATED DIRECTLY SOUTH OF MONITORING WELL 08. WELL 08 IS LOCATED ON THE NORTHWEST CORNER OF THE 56TH AVENUE AND QUEBEC INTERSECTION. THIS WAS NOT EXPECTED DURING THE PREVIOUS INVESTIGATIONS BECAUSE THE REGIONAL GROUNDWATER GRADIENT IN THIS AREA IS TO THE NORTHWEST. HOWEVER, LOCAL DIRECTIONS OF GROUND WATER FLOW MAY BE DIFFERENT DUE TO LOCAL INFLUENCE FROM A NORTH-TRENDING PALEOCHANNEL LOCATED ALONG QUEBEC ST. THIS PALEOCHANNEL MAY CAUSE GROUND WATER TO FLOW IN A MORE NORTHERLY DIRECTION.

FOR THE PURPOSES OF THE FS, A DEGRADING SOURCE WAS ASSUMED BECAUSE TRUE CONTINUING SOURCES ARE RELATIVELY RARE, AND A CONTINUING SOURCE COULD NOT BE LOCATED DURING FIELD INVESTIGATIONS. IF FUTURE MONITORING INDICATES THAT SIGNIFICANT SOURCE MATERIAL REMAINS, EPA WILL AGAIN ATTEMPT TO IDENTIFY THIS SOURCE AND REMEDIATE IT AS QUICKLY AS POSSIBLE.

BOTH OF THE PLUMES DESCRIBED ABOVE FOLLOW GROUNDWATER FLOW PATHS WHICH CONVERGE UPGRADIENT (SOUTH) OF THE SACWSD PUMPING CENTER AT EAST 77TH

AVENUE AND QUEBEC STREET. THE FUTURE MIGRATION OF THESE PLUMES DEPENDS ON THE MAJOR TRANSPORT AND FATE PROCESSES OF DISPERSION, ADSORPTION, BIODEGRATION, AND HYDROLYSIS (TCA ONLY) AND ON THE POTENTIAL FOR PLUME INTERCEPTION BY THE HIGH-DISCHARGE SACWSD WELLS.

IN ADDITION TO THE TCE AND PCE PLUMES LOCATED IN CSC OU2, A PLUME CONSISTING OF DIBROMOCHLOROPROPANE (DBCP) AND OTHER VOLATILE ORGANIC COMPOUNDS (VOCS), REFERRED TO AS THE "CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL", IS PRESENT TO THE EAST OF CSC OU2 ON THE RMA PROPERTY. THIS CONTAMINATION WAS DETECTED IN IRONDALE COMMUNITY WELLS IN 1980 AND WAS TRACED BACK TO THE WESTERN TIER OF RMA. A GROUNDWATER INTERCEPTION SYSTEM, KNOWN AS THE IRONDALE SYSTEM, WAS INSTALLED AT THE RMA BOUNDARY IN DECEMBER 1981 TO PREVENT THIS CONTAMINATION FROM MIGRATING OFF OF RMA. THIS SYSTEM USES WELLS TO EXTRACT AND INJECT THE GROUND WATER AND ACTIVATED CARBON TO REMOVE THE VOC CONTAMINATION.

BEHAVIOR OF THE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL IS INFLUENCED BY GROUNDWATER EXTRACTION PRACTICES AND SCHEDULES IN CSC OU2. DURING NORMAL OPERATIONS, SACWSD PUMPS CONSIDERABLY MORE WATER FROM THE AQUIFER DURING THE SUMMER THAN AT OTHER TIMES OF THE YEAR. THERE IS CONCERN THAT DURING PERIODS OF HIGH GROUNDWATER EXTRACTION, THE DIRECTION OF GROUNDWATER FLOW MAY BE ALTERED, CAUSING THE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL TO DEFLECT TO THE SOUTH AND PARTIALLY BYPASS THE IRONDALE SYSTEM. HOWEVER, DBCP HAS NOT BEEN DETECTED IN CSC OU2 IN THE VICINITY OF THE IRONDALE SYSTEM. IMPROVEMENTS TO THE IRONDALE SYSTEM, TO ENSURE THAT THE ENTIRE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL IS BEING CAPTURED AT ALL TIMES, ARE CURRENTLY BEING EVALUATED UNDER CERCLA AT THE RMA SITE. UNTIL THOSE IMPROVEMENTS ARE IMPLEMENTED, THE AMOUNT OF CONTAMINATION THAT MAY PERIODICALLY BYPASS THE IRONDALE SYSTEM IS CONSIDERED TO BE INSIGNIFICANT COMPARED TO THE CONTAMINATION COMING FROM OTHER SOURCES INTO CSC OU2, AND REQUIRES NO DIFFERENT REMEDY THAN THAT SELECTED FOR THE TCE/PCE PLUMES.

ONE OF THE CONTAMINANTS DETECTED IN THE CSC OU2 RI WAS VINYL CHLORIDE. THIS COMPOUND IS BELIEVED TO BE A BREAKDOWN PRODUCT OF OTHER CHLORINATED HYDROCARBONS DETECTED AT THE SITE, SUCH AS ALL FORMS OF DCE. IT WAS DETECTED ONLY SPORADICALLY WITH RESPECT TO LOCATION AND CONCENTRATION, AND IT DID NOT APPEAR TO DEFINE A CONTINUOUS PLUME. THE FOCUS OF THIS ROD IS ON THE KNOWN PLUMES OF CHLORINATED VOCS, ALTHOUGH THE REMEDIAL ACTIONS WERE ALSO EVALUATED BASED ON THEIR ABILITY TO REMOVE VINYL CHLORIDE IF IT IS PRESENT. THE PREVIOUS ROD PROVIDES THE ABILITY TO REMOVE VINYL CHLORIDE FROM THE SACWSD WATER SUPPLY IF IT BECOMES A HEALTH THREAT.

#SSR
VI. SUMMARY OF SITE RISKS

ACTUAL OR THREATENED RELEASES OF HAZARDOUS SUBSTANCES FROM BOTH OU2 AND OU3, IF NOT ADDRESSED BY IMPLEMENTING THE RESPONSE ACTION SELECTED IN THIS ROD, MAY PRESENT AN IMMINENT AND SUBSTANTIAL ENDANGERMENT TO PUBLIC HEALTH, WELFARE AND THE ENVIRONMENT.

CERCLA MANDATES THAT EPA SELECT REMEDIES THAT PROTECT HUMAN HEALTH AND THE ENVIRONMENT FROM CURRENT AND POTENTIAL EXPOSURES TO HAZARDOUS SUBSTANCES. THEREFORE, EPA HAS CONDUCTED A BASELINE RISK ASSESSMENT (BRA) TO EVALUATE THE RISK POSED BY THE PRESENCE OF CONTAMINANTS AT CSC OU2. THE RISK ANALYSIS RESULTING FROM EPA'S BRA IS USED FOR THE CSC OU2 AND OU3 FS AND FOR THIS ROD. THIS BRA WAS CARRIED OUT TO CHARACTERIZE THE CURRENT AND POTENTIAL THREATS TO HUMAN HEALTH AND THE ENVIRONMENT WHICH EXIST FOR THESE OUS IN THE ABSENCE OF ANY REMEDIAL ACTION.

THE MAJOR POTENTIAL HEALTH RISK TO AREA RESIDENTS IS ASSOCIATED WITH

THE USE OF GROUND WATER CONTAMINATED BY VOLATILE ORGANIC COMPOUNDS. THE MAJORITY OF GROUND WATER FROM CONTAMINATED MUNICIPAL WELLS IS CURRENTLY TREATED PRIOR TO DISTRIBUTION TO THE COMMUNITY. ONE UNTREATED WELL, SACWSD WELL NO. 18 IS LOCATED WITHIN THE CSC SITE AND IS CURRENTLY IMPACTED FROM CONTAMINATION AT THE SITE. APPROXIMATELY 12 REMAINING RESIDENTS WITHIN THE CSC SITE ARE SOLELY DEPENDANT ON PRIVATE ALLUVIAL WELLS FOR INDOOR USE. ENVIRONMENTAL RISKS WERE NOT CONSIDERED EXCEPT AS THEY PERTAIN TO RESTORING THE GROUND WATER. ENVIRONMENTAL RISKS FOR BOTH OU2 AND OU3 WERE NOT CONSIDERED BECAUSE THERE ARE NO IDENTIFIED EXPOSURE PATHWAYS BY WHICH SIGNIFICANT EXPOSURE TO ENVIRONMENTAL RECEPTORS COULD OCCUR.

EIGHT CONTAMINANTS WERE IDENTIFIED AS CHEMICALS OF CONCERN (COCS) BASED ON THEIR TOXICITY, WIDESPREAD OCCURRENCE, OR CONCENTRATION. THESE COMPOUNDS ARE PCE, TCE, TCA, DCA, DCE, 1,2-DCE, VC AND BENZENE. THESE CONTAMINANTS ARE JUDGED TO REPRESENT THE MAJOR POTENTIAL HEALTH RISKS AT THE SITE FOR BOTH OU2 AND OU3.

THE SELECTION CRITERIA USED TO IDENTIFY COCS FOLLOWED THE MOST RECENT GUIDANCE FROM EPA (RISK ASSESSMENT GUIDANCE FOR SUPERFUND (RAGS), VOLUME I, HUMAN HEALTH EVALUATION MANUAL (PART A) INTERIM FINAL EPA/540/1-89/002, DECEMBER 1989). A LIST OF ALL CHEMICALS DETECTED DURING THE 1989 RAS SAMPLING WAS COMPILED. THE LIST WAS REVIEWED AND CHEMICALS WERE ELIMINATED FROM FURTHER CONSIDERATION BASED ON QA/QC CRITERIA, LABORATORY OR FIELD BLANK CONTAMINATION, OR FREQUENCY OF DETECTION. A DETECTION FREQUENCY OF LESS THAN 10 PERCENT WAS USED IN THE RA TO ELIMINATE CHEMICALS NOT BELIEVED TO BE REPRESENTATIVE OF SITE CONTAMINANTS. ALTHOUGH A 5 PERCENT DETECTION FREQUENCY IS RECOMMENDED BY RAGS REFERENCED ABOVE, THIS RECOMMENDATION ALLOWS FOR PROFESSIONAL JUDGEMENT AND MODIFICATION FOR SPECIFIC SITES AND CONDITIONS. IN THE CASE OF OU2, SEVERAL YEARS OF SAMPLING INFORMATION CONSISTENTLY DETECTED THE CHEMICALS SELECTED AS COCS. OTHER CHEMICALS HAVE BEEN SPORADICALLY DETECTED AT LOW CONCENTRATIONS IN THESE SAMPLING EFFORTS, BUT THE EIGHT COCS SELECTED FOR OU2 ARE REPRESENTATIVE OF HISTORICAL AND CURRENT SITE CONTAMINATION. FURTHERMORE, THE CHEMICALS DETECTED AT 5-10 PERCENT FREQUENCY, EVEN IF THEY WERE INCLUDED IN THE RA, WOULD HAVE ONLY A MARGINAL EFFECT ON THE MAGNITUDE OF POTENTIAL HEALTH RISKS AT THE SITE.

THE EIGHT CHEMICALS REMAINING AFTER THIS PRELIMINARY REVIEW WERE CLEARLY RELEVANT TO THE RA BASED ON TOXICOLOGY, WIDESPREAD OCCURRENCE, OR CONCENTRATION. THEREFORE, NO FURTHER SELECTION CRITERIA WERE APPLIED. VINYL CHLORIDE IS INCLUDED AS A CHEMICAL OF CONCERN EVEN THOUGH IT WAS ONLY DETECTED IN FIVE PERCENT OF THE WELLS BECAUSE VINYL CHLORIDE IS A POTENT HUMAN CARCINOGEN AND RELIABILITY OF THE SAMPLING RESULTS FOR VINYL CHLORIDE IS UNCERTAIN.

TOXICITY ASSESSMENT

THE COCS ARE A DIVERSE GROUP OF VOLATILE HALOGENATED HYDROCARBONS AND SOLVENTS. MOST OF THE COCS ARE CENTRAL NERVOUS SYSTEM DEPRESSANTS AND EITHER LIVER OR KIDNEY TOXINS AT HIGH DOSES. BENZENE IS TOXIC TO THE BLOOD FORMING SYSTEM.

SIX OF THE COCS (PCE, TCE, DCE, DCA, VC AND BENZENE) ARE KNOWN TO CAUSE CARCINOGENIC EFFECTS IN ANIMAL STUDIES. OF THE SIX, VINYL CHLORIDE AND BENZENE ARE BOTH CLASSIFIED BY EPA AS CLASS A - HUMAN CARCINOGENS BASED ON THE WEIGHT-OF-EVIDENCE FOR CARCINOGENICITY.

NON-CARCINOGENIC EFFECTS - TCE IS A CENTRAL NERVOUS SYSTEM DEPRESSANT IN HUMANS. INHALATION AND ORAL EXPOSURE STUDIES IN ANIMALS INDICATE THAT BONE MARROW, CENTRAL NERVOUS SYSTEM, LIVER, AND KIDNEY ARE THE TARGET ORGANS. THE PRINCIPAL TOXIC EFFECTS OF PCE IN HUMANS AND ANIMALS ARE CENTRAL NERVOUS SYSTEM DEPRESSION AND LIVER AND KIDNEY DAMAGE. TCA IS A

CENTRAL NERVOUS SYSTEM DEPRESSANT AT HIGH CONCENTRATIONS AND ADVERSE EFFECTS ON THE CARDIOVASCULAR SYSTEM HAVE ALSO BEEN REPORTED. EXPOSURE TO HIGH CONCENTRATIONS OF DCA HAS BEEN REPORTED TO CAUSE CARDIAC ARRHYTHMIA AND LIVER DAMAGE IN HUMANS. DCE CAN INDUCE NEUROTOXICITY AFTER SHORT-TERM INHALATION EXPOSURE, AND DCE IS POSSIBLY ASSOCIATED WITH LIVER AND KIDNEY TOXICITY AFTER REPEATED, LOW-LEVEL EXPOSURE IN HUMANS. BENZENE HAS DEMONSTRATED TOXIC EFFECTS ON THE CENTRAL NERVOUS SYSTEM, BLOOD-FORMING SYSTEM, AND IMMUNE SYSTEM IN BOTH ANIMALS AND HUMANS. LONG-TERM INHALATION OF VINYL CHLORIDE BY WORKERS IS ASSOCIATED WITH LIVER DAMAGE, CENTRAL NERVOUS SYSTEM DISTURBANCES, PULMONARY INSUFFICIENCY, CARDIOVASCULAR TOXICITY, AND OSTEOLYSIS.

CARCINOGENIC EFFECTS - TCE IS CLASSIFIED AS A GROUP B2 CARCINOGEN (A PROBABLE HUMAN CARCINOGEN). PCE AND DCA ARE ALSO CLASSIFIED AS GROUP B CARCINOGENS. DCE IS CLASSIFIED AS A GROUP C CARCINOGEN (A POSSIBLE HUMAN CARCINOGEN). BENZENE AND VINYL CHLORIDE HAVE BEEN CLASSIFIED AS HUMAN CARCINOGENS (GROUP A). CLASSIFICATION INTO THIS CATEGORY MEANS THAT THERE IS SUFFICIENT EVIDENCE FROM EPIDEMIOLOGIC STUDIES TO SUPPORT A CAUSAL ASSOCIATION BETWEEN THE COMPOUND AND HUMAN CANCER.

RISK CHARACTERIZATION FOR OU2 AND OU3

BOTH CARCINOGENIC AND NON-CARCINOGENIC HEALTH RISKS WERE CHARACTERIZED FOR TWO EXPOSURE SCENARIOS. CASE 1 REPRESENTS THE MAXIMUM RANGE OF HEALTH RISKS LIKELY TO BE ENCOUNTERED BY AN INDIVIDUAL USING UNTREATED GROUND WATER AS A PRIMARY DOMESTIC WATER SOURCE (OU2). CASE 2 IS A CURRENT ESTIMATE OF POTENTIAL HEALTH RISKS ASSOCIATED WITH AN UNTREATED WELL LOCATED AT THE PERIPHERY OF THE CONTAMINATED GROUNDWATER PLUME (OU3). RISKS WERE CALCULATED FOR EACH CHEMICAL OF CONCERN FOR THE TWO EXPOSURE PATHWAYS.

NON-CARCINOGENIC RISKS - THE POTENTIAL FOR NON-CARCINOGENIC EFFECTS IS EVALUATED BY COMPARING THE ESTIMATED CHEMICAL EXPOSURE TO THE APPROPRIATE REFERENCE DOSE (RFD). THE RFD IS AN ESTIMATE OF A DAILY EXPOSURE LEVEL FOR AN INDIVIDUAL THAT IS LIKELY TO BE WITHOUT AN APPRECIABLE RISK OF DELETERIOUSEFFECTS DURING A LIFETIME. RFDS FOR CSC OU2 AND OU3 COCS ARE PRESENTED IN TABLE 1. THE RATIO OF EXPOSURE TO A TOXICITY VALUE IS DEFINED AS A HAZARD INDEX (HI). THE HAZARD INDEX IS BASED ON THE ASSUMPTION THAT THERE IS A LEVEL OF EXPOSURE, THE RFD, BELOW WHICH IT IS UNLIKELY FOR ADVERSE HEALTH EFFECTS TO OCCUR. IF THE EXPOSURE EXCEEDS THE RFD (THE HI EXCEEDS 1.0), THERE MAY BE A CONCERN FOR POTENTIAL NON-CANCER HEALTH EFFECTS.

CARCINOGENIC RISKS - POTENTIAL EXCESS CANCER RISKS ARE ESTIMATED BY MULTIPLYING AN EXPOSURE ESTIMATE BY A CANCER POTENCY FACTOR (CPF), WHICH HAS BEEN DERIVED FROM EITHER HUMAN EPIDEMIOLOGY STUDIES OR EXPERIMENTAL ANIMAL STUDIES WITH THE SPECIFIC CHEMICAL UNDER CONSIDERATION. THE CPF FOR CSC OU2 AND OU3 COCS IS PRESENTED IN TABLE 1. GENERALLY, CANCER RISKS ARE ASSUMED TO BE ADDITIVE, AS LONG AS THE EXPOSURES ARE FOR THE SAME INDIVIDUALS AND TIME PERIOD. CARCINOGENIC RISKS ARE PRESENTED AS A PROBABILITY VALUE, I.E., THE INCREASED CHANCE OF CONTRACTING SOME FORM OF CANCER OVER A LIFETIME.

IN THE RISK CHARACTERIZATION, THE AGGREGATE CARCINOGENIC RISK DUE TO INDICATOR CONTAMINANTS AT THE SITE IS COMPARED TO AN ACCEPTABLE TARGET RISK. CARCINOGENIC EFFECTS ARE EVALUATED BASED ON A CALCULATED INCREASE IN THE RISK OF CONTRACTING CANCER THAT IS A DIRECT RESULT OF EXPOSURE TO THE COCS AT A SITE. THE EPA HAS DEFINED AN INCREASED RISK, EXCEEDING THE (10-4) TO (10-6) RANGE, DUE TO EXPOSURES AT A SITE AS BEING UNACCEPTABLE REGARDING THE PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT. REMEDIATION ACTION OBJECTIVES ARE ESTABLISHED BASED ON ARARS (I.E. MCLS AND MCLG) AND ACCEPTABLE RISK LEVELS BLE (I.E. 10-6), WHILE ARARS AND THE (10-6) CANCER RISK POINT OF DEPARTURE ARE USED AS

THE BASIS FOR DEVELOPING PRELIMINARY REMEDIATION GOALS. THE CHANCE OF ONE PERSON DEVELOPING CANCER PER ONE MILLION PEOPLE (OR 10-6) IS USED AS A TARGET VALUE OR POINT OF DEPARTURE ABOVE WHICH CARCINOGENIC RISKS MAY BE CONSIDERED UNACCEPTABLE. THE (10-6) POINT OF DEPARTURE IS USED FOR DETERMINING REMEDIATION GOALS WHEN ARARS ARE NOT AVAILABLE (I.E., NO MCLS OR PROPOSED MCLS EXIST FOR THE INDICATOR CONTAMINANT) OR ARE NOT SUFFICIENTLY PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT BECAUSE OF THE EXISTANCE OF MULTIPLE CONTAMINANTS AT A SITE OR MULTIPLE PATHWAYS OF EXPOSURE.

EXPOSURE ASSESSMENT

ONLY PATHWAYS ASSOCIATED WITH GROUND WATER USES WERE EVALUATED IN THE RISK ASSESSMENT, AS IT IS THE ONLY CONTAMINATED MEDIUM AT THE SITE. TWO EXPOSURE SCENARIOS WERE DEVELOPED TO DESCRIBE A RANGE OF POTENTIAL HEALTH RISKS. FOR CASE 1, A REASONABLE MAXIMUM ESTIMATE (RME) WAS DEVELOPED BY CALCULATING EXPOSURES FROM USE OF A HYPOTHETICAL PRIVATE WELL IN OU2 PLACED WITHIN A MIXING ZONE FOR THE EXISTING GROUNDWATER PLUMES. THIS HYPOTHETICAL WELL WAS ASSUMED TO BE CONTAMINATED WITH ALL EIGHT CHEMICALS OF CONCERN. THE SECOND EXPOSURE SCENARIO (CASE 2) WAS DEVELOPED TO PROVIDE INFORMATION REGARDING THE POTENTIAL HEALTH RISKS ASSOCIATED WITH SACWSD PRODUCTION WELL SAC-18. THIS WELL IS LOCATED AT THE PERIPHERY OF THE GROUNDWATER PLUME AND IS CURRENTLY USED AS A SEASONAL SOURCE OF DOMESTIC WATER FOR PART OF THE COMMUNITY. TCE HAS BEEN DETECTED AT SAC-18. AVERAGE CONCENTRATIONS OF TCE RANGE FROM 4 UG/L TO 6 UG/L. THE MAXIMUM CONCENTRATION OF TCE THAT HAS BEEN DETECTED AT SAC-18 IS 12 UG/L. WATER FROM SAC-18 IS CURRENTLY BLENDED WITH TREATED WATER FROM THE KLEIN WATER TREATMENT PLANT TO ENSURE THAT ANY POTENTIAL CONTAMINANT CONCENTRATIONS IN THE UNTREATED WATER ARE DILUTED TO SAFE LEVELS. THIS SCENARIO PROVIDES AN ESTIMATE OF POTENTIAL HEALTH RISKS IF THE SAC-18 WATER WERE TO BE USED DIRECTLY.

THE TWO ROUTES OR EXPOSURE PATHWAYS EVALUATED QUANTITATIVELY WERE:

1. INGESTION OF THE WATER DURING NORMAL RESIDENTIAL USE, AND

2. INHALATION OF VOLATILES DURING SHOWERING.

BASEMENT VOC EXPOSURE WAS NOT EVALUATED FOR TWO REASONS: (1) A VALIDATED BASEMENT EXPOSURE MODEL WAS NOT AVAILABLE AT THE TIME THE RISK ASSESSMENT WAS PREPARED AND (2) GROUNDWATER CONCENTRATIONS WERE SO LOW WITHIN OU2 THAT THE CONTRIBUTION OF THE PATHWAY WAS JUDGED TO NOT CONTRIBUTE SIGNIFICANTLY TO THE OVERALL RISKS AT THE SITE. SUCH POTENTIAL RISKS WILL BE REEVALUATED DURING THE 5 YEAR REVIEW TO ENSURE THE REMEDIES SELECTED ARE PROTECTIVE.

REPRESENTATIVE EXPOSURE POINT CONCENTRATIONS WERE DEVELOPED FROM THE SAMPLING DATA FOR THE CONTAMINANTS OF CONCERN. FOR CASE 1, THE CONCENTRATIONS OF INDIVIDUAL CONTAMINANTS IN GROUND WATER AT THE HYPOTHETICAL WELL WERE SET EQUAL TO THE ARITHMETIC AVERAGE OF THE HIGHEST CONCENTRATIONS FROM 3-5 VALIDATED SAMPLES FROM THE 1989 SAMPLING FOR EACH CONTAMINANT OF CONCERN. A RANGE OF SAMPLE NUMBERS WAS USED BECAUSE THERE WERE DIFFERENT NUMBERS OF VALIDATED SAMPLES FOR EACH COMPOUND. THIS APPROACH WAS SELECTED TO OBTAIN A RME ESTIMATE THAT REFLECTS POTENTIAL MIXING OF DIFFERENT CONTAMINANTS FROM VARIOUS SOURCES WITHIN THE ALLUVIAL AQUIFER OF OU2. WELLS WITH THE HIGHEST CONCENTRATIONS OF INDIVIDUAL CONTAMINANTS AND AVERAGE CONTAMINANT CONCENTRATIONS CALCULATED FOR THE CASE 1 SCENARIO ARE PRESENTED IN TABLE 2. THE BEST APPROXIMATION OF THE RME FOR CASE 1 ASSUMES THAT ALL CONTAMINANTS OF CONCERN COULD BE PRESENT IN A SINGLE LOCATION BUT THAT THEIR RESPECTIVE CONCENTRATIONS WOULD NOT LIKELY EXCEED AN AVERAGE OF THE HIGHEST DETECTED VALUES. CONTAMINANT CONCENTRATIONS USED FOR CALCULATING CASE 2 EXPOSURES ARE PRESENTED IN TABLE 3. THESE ARE 1989

CONCENTRATIONS MEASURED IN WELL 18.

CALCULATIONS OF EXPOSURE FROM INGESTION OF GROUND WATER AND INHALATION OF VOLATILES WERE BASED ON STANDARD EPA GUIDANCE (RISK ASSESSMENT GUIDANCE FOR SUPERFUND (RAGS), VOLUME I, HUMAN HEALTH EVALUATION MANUAL (PART A) INTERIM FINAL EPA/540/1-89/002, DECEMBER 1989) AND THEORETICAL MODELS. EXPOSURES WERE CALCULATED BASED ONEXPOSURE POINT CONCENTRATIONS, AND THE FOLLOWING ASSUMPTIONS FOR EACH EXPOSURE ROUTE:

INGESTION OF GROUND WATER:

INGESTION RATE = 2 LITERS/DAY
EXPOSURE FREQUENCY = 365 DAY/YEAR
EXPOSURE DURATION = 30 YEARS
BODY WEIGHT = 70 KILOGRAMS

INHALATION DURING SHOWERING:

VENTILATION RATE = 15 LITERS/MINUTE
BODY WEIGHT = 70 KILOGRAMS
AIR EXCHANGE RATE = 0.008333 MINUTES-1
SHOWER DURATION = 15 MINUTES
TOTAL TIME IN SHOWER ROOM = 20 MINUTES
EXPOSURE FREQUENCY = 365 DAYS/YEAR
EXPOSURE DURATION = 30 YEARS
ADSORPTION RATE ACROSS LUNGS = 100 PERCENT

EXPOSURE ESTIMATES FOR THE CASE 1 SCENARIO FOR BOTH EXPOSURE ROUTES ARE SUMMARIZED IN TABLE 4. THE HIGHEST CHEMICAL EXPOSURES FOR BOTH ROUTES WERE FROM PCE AND TCE. EXPOSURE ESTIMATES FOR THE CASE 2 SCENARIO ARE PRESENTED IN TABLE 5. THE HIGHEST EXPOSURES WERE DUE TO TCA AND TCE.

RESULTS

THE CHRONIC HI ESTIMATES FOR CASE 1 INDICATED A VERY LOW POTENTIAL FOR NON-CANCER HEALTH EFFECTS. THE HI FOR EACH CONTAMINANT OF CONCERN WAS LESS THAN 1.0. THE HI FOR PCE, HOWEVER, WAS CONSIDERABLY HIGHER THAN FOR THE OTHERCONTAMINANTS. THIS REFLECTS THE HIGHER CONCENTRATION OF PCE IN GROUND WATER. ADDITION OF HIS FOR SPECIFIC EXPOSURE ROUTES STILL RESULTED IN A HI OF LESS THAN 1.0 FOR EACH EXPOSURE ROUTE, WITH THE LARGEST COMPONENT OF THE HI FOR EACH ROUTE DUE TO PCE. THE CHRONIC HI ESTIMATES FOR CASE 2 INDICATED AN EXTREMELY LOW POTENTIAL FOR NON-CARCINOGENIC ADVERSE HEALTH EFFECTS. THE AGGREGATE HI FOR ALL EXPOSURE ROUTES WAS ALSO SUMMED AND DID NOT EXCEED 1.0. THE HIS FOR INDIVIDUAL CONTAMINANTS WERE NEARLY TWO ORDERS OF MAGNITUDE LOWER THAN FOR CASE 1. THE INDIVIDUAL AND AGGREGATE HI FOR CSC OU2 COCS IS PRESENTED IN TABLE 6.

THE RISK ASSESSMENT REVEALED THAT DCE, VC, AND TCE POSE THE MOST SIGNIFICANT CARCINOGENIC RISKS TO HUMAN HEALTH. FOR THE CASE 1 EXPOSURE SCENARIO (RME) AS SHOWN IN TABLE 6, THE TOTAL EXCESS CANCER RISK ESTIMATE FOR ALL CHEMICALS VIA INGESTION AND INHALATION WHILE SHOWERING WAS 3.6 X (10-4). FOR THE CASE 2 EXPOSURE SCENARIO (WELL 18) AS SHOWN IN TABLE 7, THE TOTAL EXCESS CANCER RISK ESTIMATE FOR ALL CHEMICALS VIA BOTH EXPOSURE PATHWAY ROUTES WAS 2.0 X (10-5).

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VII. SUMMARY OF ALTERNATIVES

THE OU2 FS AND OU3 FS WERE CONDUCTED TO DEVELOP AND EVALUATE REMEDIAL ALTERNATIVES THAT WOULD EFFECTIVELY MINIMIZE THREATS TO AND PROVIDE ADEQUATE PROTECTION OF PUBLIC HEALTH AND THE ENVIRONMENT FROM

CONTAMINATED GROUND WATER LOCATED WITHIN THE OPERABLE UNIT BOUNDARIES. THE OU2 FS AND OU3 FS WERE CONDUCTED IN THREE PHASES: PHASE I, DEVELOPMENT OF ALTERNATIVES; PHASE II, SCREENING OF ALTERNATIVES; AND PHASE III, DETAILED ANALYSIS OF ALTERNATIVES. IN PHASE I, REMEDIALALTERNATIVES WERE ASSEMBLED FROM APPLICABLE REMEDIAL TECHNOLOGY PROCESS OPTIONS. THESE ALTERNATIVES WERE INITIALLY EVALUATED FOR EFFECTIVENESS, IMPLEMENTABILITY, AND COST IN PHASE II. THE FAVORABLE ALTERNATIVES WERE THEN EVALUATED IN DETAIL IN PHASE III WITH RESPECT TO THE FOLLOWING CRITERIA SPECIFIED IN THE NATIONAL CONTINGENCY PLAN (NCP):

* OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
* COMPLIANCE WITH ARARS
* LONG-TERM EFFECTIVENESS AND PERMANENCE
* REDUCTION OF TOXICITY, MOBILITY, OR VOLUME
* SHORT-TERM EFFECTIVENESS
* IMPLEMENTABILITY
* COST
* STATE ACCEPTANCE
* COMMUNITY ACCEPTANCE

IN ADDITION TO THE REMEDIAL ALTERNATIVES, THE NCP REQUIRES THAT A NO-ACTION ALTERNATIVE BE CONSIDERED AT EVERY SITE. THE NO-ACTION ALTERNATIVE SERVES PRIMARILY AS A POINT OF COMPARISON FOR OTHER ALTERNATIVES.

A GROUNDWATER MODEL WAS DEVELOPED FOR THE CSC OU2 SITE AS A TOOL TO AID IN DETERMINING THE RELATIVE EFFECTIVENESS OF THE REMEDIAL ACTION ALTERNATIVES. THIS MODEL WAS DEVELOPED TO ALLOW COMPARISON OF THE DIFFERENT ALTERNATIVES, RATHER THAN TO DEFINE EXACT AQUIFER CHARACTERISTICS AT FUTURE TIMES. THE MODEL WAS NOT CALIBRATED, AND MANY SIMPLIFICATIONS WERE MADE DURING ITS DEVELOPMENT. THE MODEL TAKES INTO ACCOUNT CONTAMINANT TRANSPORT BY ADVECTION, SORPTION, AND DISPERSION. CONTAMINANT DEGRADATION FROM SUCH PROCESSES AS BIOLOGICAL AND CHEMICAL BREAKDOWN ARE NOT ACCOUNTED FOR BY THE MODEL. OUTPUT FROM THE MODEL IS USEFUL TO GIVE A GENERAL IDEA OF CONTAMINANT TRANSPORT AND REMOVAL RATES RESULTING FROM REMEDIAL ACTIONS WITHIN CSC OU2. THIS INFORMATION HAS BEEN USED TO COMPARE THE EFFECTIVENESS OF THE VARIOUS TREATMENT ALTERNATIVES. THE PREDICTED AQUIFER RESTORATION TIME PERIODS DERIVED FOR THE VARIOUS ALTERNATIVES EVALUATED IN THE OU2 FS WERE USED TO ESTIMATE DURATION OF RESIDENTIAL EXPOSURE EVALUATED IN THE OU3 FS.

REMEDIAL ACTION OBJECTIVES AND GOALS

REMEDIAL ACTION OBJECTIVES FOR ESTABLISHING ACCEPTABLE GROUNDWATER REMEDIATION AND EXPOSURE LEVELS WERE DEVELOPED FROM APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS) AND FROM RISK-BASED CONSIDERATIONS. THE STANDARDS, REQUIREMENTS, LIMITATIONS, AND CRITERIA THAT WERE CONSIDERED TO BE APPLICABLE OR RELEVANT AND APPROPRIATE FOR REMEDIATION AT CSC OU2 AND CSC OU3 INCLUDE CHEMICAL, LOCATION, AND ACTION-SPECIFIC REQUIREMENTS.

CHEMICAL-SPECIFIC ARARS PERTAINING TO WATER QUALITY INCLUDE REQUIREMENTS FROM THE FEDERAL SAFE DRINKING WATER ACT (SDWA) AND RESOURCE CONSERVATION AND RECOVERY ACT (RCRA). STATE LAWS THAT WERE CONSIDERED ARE THE STATE PRIMARY DRINKING WATER REGULATIONS AND THE COLORADO WATER QUALITY CONTROL ACT. ACCEPTABLE CONCENTRATION LIMITS HAVE BEEN ESTABLISHED PURSUANT TO THESE LAWS AND ARE RELEVANT AND APPROPRIATE IN ESTABLISHING ACCEPTABLE CONCENTRATION LEVELS FOR THE ALLUVIAL AQUIFER IN CSC OU2 IN ORDER THAT THE AQUIFER WILL BE RESTORED TO A QUALITY THAT WILL ALLOW ITS FUTURE BENEFICIAL USE. THESE LEVELS ARE ALSO USED IN ESTABLISHING ACCEPTABLE LEVELS OF EXPOSURE FOR INDOOR USE FOR OU3. THE LEVELS ESTABLISHED UNDER THE SDWA ARE REFERRED TO AS MAXIMUM CONTAMINANT LEVELS (MCLS). MCLS ARE ENFORCEABLE DRINKING WATER STANDARDS THAT REGULATE PUBLIC DRINKING WATER SUPPLY SYSTEMS. "MAXIMUM CONTAMINANT

LEVEL GOALS (MCLGS), ESTABLISHED UNDER THE SAFE DRINKING WATER ACT, THAT ARE SET AT LEVELS ABOVE ZERO, SHALL BE ATTAINED BY REMEDIAL ACTIONS FOR GROUND OR SURFACE WATERS THAT ARE CURRENT OR POTENTIAL SOURCES OF DRINKING WATER, WHERE THE MCLGS ARE RELEVANT AND APPROPRIATE UNDER THE CIRCUMSTANCES OF THE RELEASE BASED ON THE FACTORS IN S 300.400(G)(2). IF AN MCLG IS DETERMINED NOT TO BE RELEVANT AND APPROPRIATE, THE CORRESPONDING MAXIMUM CONTAMINANT LEVEL (MCL) SHALL BE ATTAINED WHERE RELEVANT AND APPROPRIATE TO THE CIRCUMSTANCES OF THE RELEASE. WHERE THE MCLG FOR A CONTAMINANT HAS BEEN SET AT A LEVEL OF ZERO, THE MCL PROMULGATED FOR THAT CONTAMINANT UNDER THE SAFE DRINKING WATER ACT SHALL BE ATTAINED BY REMEDIAL ACTIONS FOR GROUND OR SURFACE WATERS THAT ARE CURRENT OR POTENTIAL SOURCES OF DRINKING WATER, WHERE THE MCL IS RELEVANT AND APPROPRIATE UNDER THE CIRCUMSTANCES OF THE RELEASE BASED ON THE FACTORS IN S 300.400(G)(2). IN CASES INVOLVING MULTIPLE CONTAMINANTS OR PATHWAYS WHERE ATTAINMENT OF CHEMICAL-SPECIFIC ARARS WILL RESULT IN CUMULATIVE RISK IN EXCESS OF (10-4), CRITERIA IN PARAGRAPH S 300.400(E)(2)(I)(A) OF THIS SECTION MAY ALSO BE CONSIDERED WHEN DETERMINING THE CLEANUP LEVEL TO BE ATTAINED." (40 CFR 300.430 (E)(2)(I)(B)). UNDER THE SDWA, MCLS HAVE BEEN ESTABLISHED FOR DCE, TCA, TCE, BENZENE AND VINYL CHLORIDE. CUMULATIVE CARCINOGENIC RISK FOR THESE COMPOUNDS ASSOCIATED WITH THE REMEDIATION LEVELS THROUGH INGESTION AND INHALATION DURING SHOWERING IS ESTIMATED AT 1 X (10-4). SINCE THIS RISK IS CONSIDERED TO BE PROTECTIVE, MCLS FOR THESE CHEMICALS ARE USED FOR ESTABLISHING ACCEPTABLE REMEDIATION AND EXPOSURE LEVELS.

IF NO ARAR COVERS A PARTICULAR SITUATION, OR IF AN ARAR IS NOT SUFFICIENT TO PROTECT PUBLIC HEALTH OR THE ENVIRONMENT, PROPOSED STANDARDS, CRITERIA, GUIDANCE AND ADVISORIES ARE USED AS "TO BE CONSIDERED" OR TBCS TO PROVIDE A STANDARD OR GOAL. PROPOSED MCLS UNDER THE SDWA ARE CONSIDERED TO BE TBCS IN ESTABLISHING ACCEPTABLE CONCENTRATION LEVELS FOR THOSE COMPOUNDS WITHOUT A PROMULGATED MCL OR STATE STANDARD. FOR THOSE CONTAMINANTS WITHOUT TBCS, ACCEPTABLE LEVELS MAY BE DERIVED BASED ON THE (10-6) RISK LEVEL. BECAUSE CLEAN-UP CAN ONLY BE VERIFIED DOWN TO THE LABORATORY ANALYTICAL DETECTION LIMIT, IT IS IMPORTANT THAT DETECTION LIMITS ARE EITHER EQUIVALENT TO OR LESS THAN THE REMEDIATION LEVELS FOR THE COCS. FOR THIS SITE, IT WAS ASSUMED THAT SAMPLES WILL BE ANALYZED UNDER THE CONTRACT LABORATORY PROGRAM (CLP) USING EITHER ROUTINE ANALYTICAL SERVICES (RAS) OR SPECIAL ANALYTICAL SERVICES (SAS) PROTOCOLS, AND THAT METHOD DETECTION LIMITS AS SUGGESTED BY EPA METHODS WILL BE ATTAINABLE. ACCEPTABLE REMEDIATION AND EXPOSURE LEVELS AND APPROPRIATE ANALYTICAL METHODS AND THEIR DETECTION LIMITS FOR THE COCS AT THIS SITE ARE PRESENTED IN TABLE 8 ALONG WITH THE GOVERNING ARAR (IF AVAILABLE).

THE FOLLOWING REMEDIAL ACTION OBJECTIVES WERE IDENTIFIED FOR BOTH CSC OU2 AND OU3:

1. PREVENT THE INGESTION AND INHALATION THROUGH SHOWERING OF CHEMICALS OF CONCERN IN EXCESS OF LEVELS SPECIFIED IN TABLE 8 AND A TOTAL CARCINOGENIC RISK IN EXCESS OF (10-4) TO (10-6). THIS REMEDIAL ACTION OBJECTIVE WILL BE ADDRESSED UNDER CSC OU3.

2. RESTORE THE ALLUVIAL AQUIFER FOR CHEMICALS OF CONCERN TO LEVELS SPECIFIED IN TABLE 8 AND TO LEVELS WHICH POSE A (10-4) TO (10-6) TOTAL EXCESS CANCER RISK. THIS REMEDIAL ACTION OBJECTIVE IS ADDRESSED UNDER CSC OU2.

3. PREVENT MIGRATION OF CONTAMINANTS IN EXCESS OF LEVELS SPECIFIED IN TABLE 8. THIS REMEDIAL ACTION OBJECTIVE IS ADDRESSED UNDER CSC OU2.

REMEDIATION LEVELS FOR CSC OU2

FOR OPERABLE UNIT 2, THREE REMEDIAL ALTERNATIVES WERE CONSIDERED FOR DETAILED EVALUATION AND ARE DESCRIBED BELOW. ALL ALTERNATIVES PERTAIN TO GROUNDWATER REMEDIATION. THREE DIFFERENT TREATMENT TECHNOLOGIES WERE EVALUATED UNDER THESE ALTERNATIVES FOR TREATING CONTAMINATED GROUND WATER ASSOCIATED WITH THE PCE PLUME. IN EVALUATING THESE ALTERNATIVES, IT WAS ASSUMED THAT REMEDIAL ACTION OBJECTIVES FOR OU1 AND OU3 WOULD BE MET. THESE OBJECTIVES INCLUDE PREVENTING THE MIGRATION OF CONTAMINATED GROUND WATER FROM OU1 INTO OU2, AND PROTECTING RESIDENTS CURRENTLY USING SHALLOW ALLUVIAL WELLS FROM EXPOSURES TO CONTAMINATED GROUND WATER.

GROUNDWATER CONTAMINATION IN CSC OU2 CAN BE VIEWED AS THREE SEPARATE PROBLEMS: 1) TCE AND OTHER VOCS ENTERING THE SITE FROM A SOURCE TO THE SOUTH, 2) A PCE PLUME AND UNKNOWN SOURCE NEAR 56TH AVENUE AND QUEBEC STREET, AND 3) CONTAMINATION CURRENTLY EXISTING IN THE AQUIFER. TCE ENTERING THE SITE FROM THE SOUTH WILL BE ADDRESSED BY THE CSC OU1 ROD. IT HAS BEEN ASSUMED IN THIS ROD THAT THE TCE WILL BE PREVENTED FROM ENTERING THE CSC OU2 SITE THROUGH REMEDIAL ACTIVITIES AT THE CSC OU1 SITE. REMEDIAL ALTERNATIVES THAT HAVE BEEN IDENTIFIED IN THE CSC OU1 FS TO ACHIEVE THIS OBJECTIVE INVOLVE THE INSTALLATION OF GROUND WATER PUMP AND TREAT SYSTEMS AT OR NEAR THE CSC PROPERTY AND AT SAND CREEK. BECAUSE THESE ACTIVITIES WILL BE CONDUCTED UNDER ANOTHER ROD, ALTERNATIVES DEVELOPED IN THIS ROD DO NOT INCLUDE TCE TREATMENT AS IT ENTERS THE CSC OU2 SITE.

THE SECOND PROBLEM, THE PCE PLUME AND UNKNOWN SOURCE NEAR 56TH AVENUE AND QUEBEC STREET, IS ADDRESSED BY THIS ROD.

THE FINAL PROBLEM, REMEDIATION OF THE EXISTING PLUME IN CSC OU2, IS ALREADY BEING ADDRESSED, IN PART, BY OPERATION OF THE KLEIN WATER TREATMENT PLANT. GROUND WATER FROM SACWSD SUPPLY WELLS IS PUMPED TO THE KLEIN WATER TREATMENT PLANT FOR TREATMENT BEFORE IT ENTERS THE MUNICIPAL DISTRIBUTION SYSTEM. SACWSD SUPPLIES NEARLY ALL OF THE RESIDENCES IN CSC OU2 WITH DOMESTIC WATER AND REPRESENTS BY FAR THE LARGEST DEMAND ON THE AQUIFER AT THIS SITE. TO MEET THE WATER DEMAND, SACWSD EXTRACTION WELLS HAVE BEEN LOCATED IN HIGHLY TRANSMISSIVE AREAS OF THE AQUIFER, MOST NOTABLY THE PALEOCHANNEL THAT RUNS NORTH APPROXIMATELY BENEATH QUEBEC STREET. BECAUSE CONTAMINANT PLUMES IN THE AQUIFER WILL TEND TO MIGRATE MOST QUICKLY THROUGH THESE HIGHLY TRANSMISSIVE PORTIONS OF THE AQUIFER, THE SACWSD EXTRACTION WELLS ARE FORTUITOUSLY OPTIMALLY LOCATED TO CAPTURE CONTAMINATED GROUND WATER AS WELL. IT WOULD BE DIFFICULT TO LOCATE ADDITIONAL EXTRACTION WELLS THROUGHOUT CSC OU2 TO ACHIEVE BETTER CONTAMINANT CAPTURE THAN WHAT IS CURRENTLY BEING DONE BY THE SACWSD WELLS. THE KLEIN PLANT IS ALSO LARGE ENOUGH (12 MILLION GALLONS PER DAY, MAXIMUM CAPACITY) THAT CONSTRUCTION OF ADDITIONAL TREATMENT FACILITIES WILL NOT PROVIDE SIGNIFICANTLY MORE EFFECTIVE OR QUICKER REMEDIATION. THEREFORE, OPTIONS FOR REMEDIATING THE PLUME CENTER ON INCREASED PUMPING OF SACWSD WELLS THAT FEED THE KLEIN WATER TREATMENT PLANT.

EACH REMEDIAL ALTERNATIVE INCLUDES THE FOLLOWING COMMON ELEMENTS:

* CONTINUED OPERATION OF THE KLEIN WATER TREATMENT PLANT TO PROTECT MUNICIPAL WATER USERS IN CSC OU2. THE KLEIN WATER TREATMENT PLANT IS AN ACTIVATED CARBON SYSTEM THAT WAS INSTALLED SPECIFICALLY TO REMOVED CHLORINATED HYDROCARBONS FROM GROUND WATER THAT IS EXTRACTED BY SACWSD FOR MUNICIPAL USE.

* MONITORING OF SELECTED WELLS TO ENSURE THAT THE REMEDIAL ACTION IS EFFECTIVE AND TO DETERMINE WHEN THE REMEDIAL ACTION CAN BE DISCONTINUED BASED ON RECOVERY OF THE AQUIFER AND ELIMINATION OF CONTAMINANT MIGRATION INTO OU2.

WITH THE EXCEPTION OF THE NO-ACTION ALTERNATIVE, EACH ALTERNATIVE FURTHER INCLUDES THE FOLLOWING COMMON ELEMENTS:

* ABANDONMENT OF BEDROCK WELLS. IF ANY BEDROCK WELL IS DETERMINED TO CAUSE CONTAMINATION TO FLOW FROM THE ALLUVIAL TO THE BEDROCK AQUIFER, THE WELL WOULD BE PROPERLY ABANDONED PROVIDED THAT PERMISSION IS GRANTED BY THE WELL OWNER. THE CRITERIA FOR BEDROCK WELL ABANDONMENT WILL BE ESTABLISHED IN RD.

ALTERNATIVE 1 - NO ACTION

A NO-ACTION REMEDIAL ALTERNATIVE IS REQUIRED BY THE NCP AND IS USED AS A BASELINE FOR COMPARISON OF OTHER ALTERNATIVES. THE NO ACTION ALTERNATIVE ASSUMES THAT NO REMEDIAL ACTIVITIES WILL BE UNDERTAKEN BEYOND ACTIVITIES CURRENTLY BEING CONDUCTED OR CURRENTLY PLANNED WITHIN AND OUTSIDE OF CSC OU2. ACTIVITIES CURRENTLY BEING CONDUCTED WITHIN CSC OU2 INCLUDE OPERATION OF THE KLEIN WATER TREATMENT PLANT AT ITS CURRENT RATE OF OPERATION TO PROTECT MUNICIPAL WATER USERS IN CSC OU2; MONITORING OF SELECTED WELLS BY SACWSD; AND PROVIDING ALTERNATE WATER SUPPLIES TO PRIVATE ALLUVIAL WELL USERS IN CSC OU2. GROUNDWATER MONITORING WOULD CONTINUE AT A MINIMUM OF AN ANNUAL BASIS AT APPROXIMATELY 15 WELLS IN OU2. MEASURED CONCENTRATIONS WOULD BE USED TO UPDATE THE PREDICTION OF CONTAMINANT MIGRATION PATTERNS AND IMPACTS ON THE SACWSD MUNICIPAL WATER SUPPLY SYSTEM.

THIS ALTERNATIVE ASSUMES THAT REMEDIAL ACTION OBJECTIVES WILL BE MET FOR CSC OU1 AND CSC OU3. THE CSC OU1 REMEDIAL ACTION OBJECTIVES INCLUDE PREVENTING CONTAMINATED GROUND WATER FROM MIGRATING INTO CSC OU2 FROM OU1. IT IS ASSUMED THAT THIS OBJECTIVE WILL BE MET AND THE SOURCE OF TCE ENTERING CSC OU2 FROM THE SOUTH WILL BE REMEDIATED BY 1993. THIS ALLOWS ADEQUATE TIME FOR REMEDIAL ACTIVITIES TO BE IMPLEMENTED IN OU1. THE REMEDIAL ACTION OBJECTIVE FOR CSC OU3 IS TO REDUCE RISK TO ACCEPTABLE LEVELS POSED BY DOMESTIC USE OF CONTAMINATED GROUND WATER FROM PRIVATE ALLUVIAL WELLS. IT IS ASSUMED THAT THIS OBJECTIVE WILL ALSO BE MET AND THAT RESIDENCES IN CSC OU2 THAT ARE CURRENTLY DEPENDENT ON SHALLOW ALLUVIAL WELLS WILL BE PROTECTED FROM EXPOSURES TO CONTAMINATED GROUND WATER BY CSC OU3 REMEDIAL ACTIONS. THIS ALTERNATIVE ALSO ASSUMES THAT THE PCE SOURCE AT 56TH AVENUE AND QUEBEC STREET IS A DEGRADING SOURCE AND WILL NOT BE REMEDIATED.

UNDER THE NO ACTION ALTERNATIVE, NATURAL ATTENUATION AND GROUNDWATER FLOW AIDED BY NORMAL PUMPING OF THE AQUIFER BY SACWSD AND OPERATION OF THE KLEIN WATER TREATMENT PLANT WOULD BE THE PRIMARY MEANS OF RESTORING THE AQUIFER. A PORTION OF THE RESIDUAL CONTAMINATION IN THE AQUIFER WOULD BE CAPTURED BY THE SACWSD WITHDRAWALS. THIS WATER WOULD THEN BE TREATED AT THE KLEIN WATER TREATMENT PLANT PRIOR TO ENTERING THE MUNICIPAL WATER SUPPLY SYSTEM.

THE MODEL RESULTS SHOWED THAT BY THE YEARS 2010/2011, 53 PERCENT OF THE TCE PLUME AND 49 PERCENT OF THE PCE PLUME WOULD BE CAPTURED AND REMEDIATED BEFORE MOVING OUT OF RANGE OF THE SACWSD WELLS FEEDING THE KLEIN WATER TREATMENT PLANT. MODEL RESULTS PREDICTED THAT TCE AND PCE CONCENTRATIONS WOULD BE REDUCED TO REMEDIATION LEVELS BY THE YEAR 2015, WHEN THE PLUME WOULD HAVE MOVED OUT OF THE MODELED AREA. COSTS FOR THIS ALTERNATIVE ARE SUMMARIZED BELOW AND INCLUDE ANNUAL SAMPLING OF 15 EXISTING WELLS. THE LIFE OF THIS ALTERNATIVE WAS ASSUMED TO BE APPROXIMATELY 20 YEARS BECAUSE THIS IS THE ESTIMATED TIME REQUIRED FOR THE PLUME TO REACH REMEDIATION LEVELS WITHIN THE MODELED AREA.

ASSUMED LIFE OF THE ALTERNATIVE:	20 YEARS
CAPITAL COSTS:	$2,600
ANNUAL COSTS (SAMPLING & ANALYSIS) :	$27,000
PRESENT WORTH OF ANNUAL COSTS:	$261,000
TOTAL CAPITAL COST AND PRESENT WORTH:	$263,600

TO DETERMINE PRESENT WORTH OF ANNUAL COSTS, PLEASE USE THE FOLLOWING FORMULA WHERE I IS THE INTEREST RATE IN DECIMALS AND N IS THE NUMBER OF YEARS.

PRESENT WORTH FACTOR = {(1+I)N-1}/{I(1+I)N}

ALTERNATIVE 2 - PCE PLUME TREATMENT WITH HYDRAULIC CONTAINMENT AND STANDARD PUMPING OF SACWSD WELLS

THIS ALTERNATIVE INCLUDES THE EXTRACTION OF CONTAMINATED GROUND WATER, TREATMENT OF THE GROUND WATER, AND REINJECTION OF THE TREATED WATER. THIS ALTERNATIVE ALSO INCLUDES THE EXISTING AND PLANNED ACTIVITIES DESCRIBED IN ALTERNATIVE 1 PLUS THE OPTION TO INITIATE BEDROCK WELL ABANDONMENT PROGRAMS. THE EXTRACTION SYSTEM WOULD BE INSTALLED TO EXTRACT THE MAXIMUM AMOUNT OF THE PCE PLUME POSSIBLE. GROUNDWATER EXTRACTION AND REINJECTION WOULD BE ACCOMPLISHED THROUGH A SERIES OF PUMPING AND INJECTION WELLS WHOSE CONFIGURATION WOULD BE DETERMINED DURING REMEDIAL DESIGN. THE PUMPED WATER WOULD BE COLLECTED IN A HEADER PIPE AND TRANSPORTED TO THE TREATMENT SYSTEM, TREATED TO HEALTH BASED LEVELS, AS SPECIFIED IN TABLE 1, AND TRANSPORTED TO THE REINJECTION WELLS. THE TREATED GROUND WATER WOULD BE REINJECTED INTO THE ALLUVIAL AQUIFER UPGRADIENT TO ENHANCE FLUSHING OF CONTAMINATED GROUND WATER. THIS ALTERNATIVE WOULD BE OPERATIONAL UNTIL THE PCE PLUME WAS REDUCED TO REMEDIATION LEVELS IDENTIFIED FOR THIS SITE IN TABLE 6. FOR THE PURPOSES OF THE FS EVALUATION, AND BASED ON MODEL RESULTS, IT WAS ASSUMED THAT THE PCE SOURCE WOULD BE REMEDIATED WITHIN EIGHT YEARS. THEREFORE, THE LIFE OF THIS PUMP AND TREAT SYSTEM WAS ASSUMED TO BE EIGHT YEARS. THE MODEL RESULTS SHOWED THAT BY THE YEAR 2006, 84 PERCENT OF THE PCE PLUME WOULD BE CAPTURED. AT THIS TIME, THE MODEL PREDICTED THAT PCE CONCENTRATIONS WOULD BE BELOW REMEDIATION LEVELS FOR THE OU2 SITE.

THE TREATED GROUND WATER WOULD BE SAMPLED AS NECESSARY TO SUBSTANTIVELY COMPLY WITH UNDERGROUND INJECTION CONTROL (UIC) REQUIREMENTS (40 CFR 144, AND 146, RCRA REQUIREMENT SECTION 3020 AND COLORADO REGULATIONS 5 CCR 1002-2, 6.1.0; 5 CCR 1002-3 SEC. 10.1.0 AND 6 CCR 1007-3 SECTION 100.21(B)). UNDER THESE REQUIREMENTS, REINJECTED GROUND WATER MUST BE TREATED TO HEALTH BASED LEVELS (I.E. MCLGS, MCLS, PROPOSED MCLS AND (10-6) EXCESS CANCER RISK LEVELS).

THE HAZARDOUS AND SOLID WASTE AMENDMENTS (HSWA) INCLUDE SPECIFIC PROVISIONS RESTRICTING THE LAND DISPOSAL OF RCRA HAZARDOUS WASTES. THESE LAND DISPOSAL RESTRICTIONS (LDRS) WERE ADOPTED TO MINIMIZE THE POTENTIAL OF FUTURE RISK TO HUMAN HEALTH AND THE ENVIRONMENT BY REQUIRING HAZARDOUS WASTE TREATMENT BEFORE LAND DISPOSAL. THE ONLY ON-SITE PORTION OF THE REMEDIAL ACTION WHICH WOULD POTENTIALLY CONSTITUTE LAND DISPOSAL OR "PLACEMENT" IS THE DISCHARGE OF TREATED WATER TO THE INJECTION TRENCH. HOWEVER, EPA POLICY (APPLICABILITY OF LAND DISPOSAL RESTRICTIONS TO RCRA AND CERCLA GROUND WATER TREATMENT INJECTION SUPERFUND MANAGEMENT REVIEW: RECOMMENDATION NO. 26 OSWER DIRECTIVE NO. 9234.1-06, DECEMBER 27, 1989) IS THAT UIC RULES TAKE PRECEDENCE OVER LDRS FOR INJECTION OF HAZARDOUS WASTE INTO THE GROUND WATER. THEREFORE, FOR INJECTION OF THE TREATED WATER, THE LDRS ARE NOT RELEVANT AND APPROPRIATE. HOWEVER, AS NOTED PREVIOUSLY, UIC REGULATIONS ARE APPLICABLE TO THIS ACTION.

COSTS FOR THIS ALTERNATIVE INCLUDE MONITORING AND THE EXTRACTION AND INJECTION SYSTEMS ONLY. BECAUSE THIS SYSTEM WILL BE USED IN CONJUNCTION WITH ONE OF THE TREATMENT OPTIONS DESCRIBED BELOW, THE COST OF THE EXTRACTION AND INJECTION SYSTEM HAS BEEN INCLUDED WITH THE COSTS FOR THE INDIVIDUAL TREATMENT OPTIONS. THESE TREATMENT OPTIONS ARE PRESENTED IN THE FOLLOWING SUB-ALTERNATIVES. COSTS FOR THE EXTRACTION AND INJECTION SYSTEM ARE BASED ON FOUR EXTRACTION WELLS AND SIX INJECTION WELLS, ALL

APPROXIMATELY 70 FEET DEEP.

ALTERNATIVE 2A - PCE PLUME TREATMENT USING CARBON ADSORPTION

IN THIS ALTERNATIVE, ACTIVATED CARBON WOULD BE USED TO TREAT CONTAMINATED GROUND WATER. INFLUENT FROM THE EXTRACTION WELLS WOULD BE COLLECTED IN A SURGE/INLET TANK, AND THEN FILTERED PRIOR TO ENTERING THE ACTIVATED CARBON CONTACTORS. TREATED WATER EXITING THE CONTACTORS WOULD BE SENT TO A PRESSURIZED STORAGE TANK AND THEN PIPED TO THE INJECTION WELLS. CARBON IN THE CONTACTORS WOULD REQUIRE REGENERATION APPROXIMATELY EVERY NINE MONTHS AT AN OFF-SITE LOCATION. THE LIFE OF THIS TREATMENT SYSTEM WAS ESTIMATED TO BE EIGHT YEARS.

THIS TYPE OF TREATMENT IS EFFECTIVE IN TREATING CONTAMINATED GROUND WATER TO HEALTH BASED LEVELS AS PRESENTED IN TABLE 8 FOR ALL CSC OU2 COCS EXCEPT VINYL CHLORIDE. VINYL CHLORIDE DOES NOT READILY ADSORB TO ACTIVATED CARBON.

COSTS ASSOCIATED WITH THIS ALTERNATIVE ARE SUMMARIZED BELOW. COSTS FOR THE MONITORING ACTIVITIES ARE SHOWN SEPARATELY, WHILE THE COST OF THE CARBON ADSORPTION SYSTEM INCLUDES THE GROUNDWATER EXTRACTION AND INJECTION SYSTEM.

THE CAPITAL COSTS FOR THE CARBON TREATMENT SYSTEM INCLUDE A PACKAGED GRANULAR ACTIVATED CARBON (GAC) SYSTEM WITH ASSOCIATED FILTERS, TANKS, AND PUMPS; CONSTRUCTION EQUIPMENT AND LABOR; LAND AND SITE DEVELOPMENT; BUILDING AND UTILITIES; CONTRACTOR'S COSTS; AND ENGINEERING AND DESIGN. ANNUAL AND PERIODIC COSTS INCLUDE OPERATION AND MAINTENANCE AND CARBON CHANGE-OUTS. THE COSTS OF THE MONITORING PROGRAM AND THE CARBON ADSORPTION PROGRAM ARE LISTED BELOW.

ASSUMED LIFE OF THE ALTERNATIVE: 20 YEARS

MONITORING PROGRAM (20 YEARS)	
CAPITAL COSTS:	$ 2,600
ANNUAL COSTS (SAMPLING AND ANALYSIS): $ 27,000	
PRESENT WORTH OF ANNUAL COSTS:	$ 261,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$ 263,600
CARBON ADSORPTION PROGRAM (8 YEARS)	
CAPITAL COSTS:	$1,910,000
ANNUAL AND PERIODIC COSTS:	$ 62,000
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS:	$1,230,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$3,140,000

ALTERNATIVE 2B - PCE PLUME TREATMENT USING UV-OXIDATION

IN THIS ALTERNATIVE, CONTAMINATED GROUND WATER WOULD BE TREATED BY UV-OXIDATION. INFLUENT FROM THE EXTRACTION WELLS WOULD BE COLLECTED IN A SURGE/INLET TANK. HYDROGEN PEROXIDE WOULD BE ADDED TO THE INLET STREAM, WHICH WOULD THEN BE FILTERED PRIOR TO ENTERING THE TREATMENT VESSEL. OZONE WOULD BE GENERATED FROM ATMOSPHERIC AIR AND BUBBLED THROUGH THE TREATMENT VESSEL, AND UV LAMPS WOULD BE INSERTED INTO THE WATER BEING TREATED. TREATED WATER WOULD BE ROUTED TO A STORAGE TANK AND THEN PUMPED TO THE INJECTION WELLS. EXCESS OZONE FROM THE TREATMENT VESSEL WOULD BE SENT THROUGH AN OZONE DECOMPOSER PRIOR TO BEING DISCHARGED TO THE ATMOSPHERE. THIS TYPE OF TECHNOLOGY IS CAPABLE OF TREATING ALL CSC OU2 COCS TO HEALTH BASED LEVELS. EXTENSIVE TESTING, HOWEVER, WOULD BE REQUIRED TO DETERMINE APPROPRIATE ADJUSTMENTS PRIOR TO FINAL DESIGN AND CONSTRUCTION OF THE SYSTEM.

COSTS ASSOCIATED WITH THIS ALTERNATIVE ARE SUMMARIZED BELOW. COSTS FOR THE MONITORING ACTIVITIES ARE SHOWN SEPARATELY, WHILE THE COST OF THE UV-OXIDATION SYSTEM INCLUDES THE GROUNDWATER EXTRACTION AND INJECTION SYSTEM.

THE CAPITAL COSTS FOR THE UV-OXIDATION TREATMENT SYSTEM INCLUDE UV-OXIDATION UNITS WITH ASSOCIATED FILTERS, TANKS, AND PUMPS; CONSTRUCTION EQUIPMENT AND LABOR; LAND AND SITE DEVELOPMENT; BUILDING AND UTILITIES; CONTRACTOR'S COSTS; AND ENGINEERING DESIGN. ANNUAL COSTS COVER OPERATION AND MAINTENANCE, INCLUDING POWER REQUIREMENTS FOR OPERATION OF THE UV LIGHTS AND OZONE GENERATION. THE COSTS OF THE MONITORING PROGRAM AND THE UV-OXIDATION PROGRAM ARE LISTED BELOW.

ASSUMED LIFE OF THE ALTERNATIVE: 20 YEARS

MONITORING PROGRAM (20 YEARS)

CAPITAL COSTS:	$ 2,600
ANNUAL COSTS (SAMPLING AND ANALYSIS):	$ 27,000
PRESENT WORTH OF ANNUAL COSTS:	$ 261,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$ 263,600

UV-OXIDATION PROGRAM (8 YEARS)

CAPITAL COSTS:	$1,950,000
ANNUAL AND PERIODIC COSTS:	$ 277,000
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS:	$1,310,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$3,260,000

ALTERNATIVE 2C - PCE PLUME TREATMENT USING AIR STRIPPING

THIS ALTERNATIVE INVOLVES TREATMENT OF CONTAMINATED GROUND WATER BY AIR STRIPPING. INFLUENT FROM THE EXTRACTION WELLS WOULD BE COLLECTED IN A SURGE/INLET TANK. EXTRACTED WATER WOULD BE FILTERED PRIOR TO ENTERING TWO AIR STRIPPING TOWERS IN PARALLEL, WHERE IT WOULD FLOW DOWN THE PACKING BY GRAVITY. TREATED WATER WOULD BE COLLECTED IN A STORAGE TANK AND THEN PUMPED TO THE INJECTION WELLS. AIR WOULD BE FORCED UPWARDS THROUGH THE COLUMNS WITH AN AIR BLOWER AND WOULD BE DISCHARGED TO THE ATMOSPHERE FROM THE TOP OF THE COLUMNS.

THE CSC OU2 SITE IS LOCATED IN AN OZONE NON-ATTAINMENT AREA. EPA POLICY (CONTROL OF AIR EMISSIONS FROM SUPERFUND AIR STRIPPERS AT SUPERFUND GROUNDWATER SITES, OSWER DIRECTIVE 9355.0-28) RECOMMENDS CONTROLS FOR AIR EMISSIONS EXCEEDING 3 POUNDS PER HOUR, 15 POUNDS PER DAY AND 10 TONS PER YEAR. THE MAXIMUM UNCONTROLLED VOLATILE ORGANIC COMPOUND (VOC) EMISSIONS RATE FROM AN AIR STRIPPING UNIT IN CSC OU2 IS ESTIMATED TO BE 0.03 POUNDS PER HOUR OR ABOUT 0.79 POUNDS PER DAY.

COLORADO AIR QUALITY REGULATIONS NOS. 1,2,3,7 AND 8 ARE APPLICABLE REQUIREMENTS FOR THIS ACTION. THE SPECIFIC CITATIONS OF THESE REGULATIONS AND THEIR PURPOSE ARE AS FOLLOWS: (A) 5 CCR 1001-5, REG.3, REQUIRES AIR POLLUTION EMISSION NOTICES (APENS); (B) 5 CCR 1001-5 SEC. IVD, REG.3, REGULATES THE ATTAINMENT AND MAINTENANCE OF ANY NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS); (C) 5 CCR 1001-9, REG. 7, REGULATES EMISSIONS OF VOLATILE COMPOUNDS, REQUIRES A REASONABLE AVAILABLE CONTROL TECHNOLOGY (RACT) EVALUATION FOR SOURCES EMITTING GREATER THAN ONE POUND PER DAY; (D) 5 CCR 1001-10, REG. 8, REGULATES VINYL CHLORIDE EMISSIONS; AND (E) 5 CCR 1001-4, REG. 2, REQUIRES THAT THE DESIGN PROVIDE FOR AN ODOR-FREE OPERATION. FEDERAL ARARS PERTAINING TO THIS ACTION INCLUDE NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FOR REGULATING VINYL CHLORIDE EMISSIONS (40 CFR 61). AIR EMISSION CONTROLS HAVE NOT BEEN PLANNED FOR THIS ACTION AS THE TOTAL VOC EMISSIONS ARE CALCULATED TO BE LESS THAN ACCEPTABLE EMISSION RATE LEVELS ALLOWED BY FEDERAL AND STATE REQUIREMENTS. HOWEVER, AIR EMISSION MONITORING WILL BE CONDUCTED TO VERIFY THAT EMISSIONS DO NOT EXCEED THE STANDARDS.

COSTS ASSOCIATED WITH THIS ALTERNATIVE ARE SUMMARIZED BELOW. COSTS FOR THE MONITORING ACTIVITIES ARE SHOWN SEPARATELY, WHILE THE COST OF THE AIR STRIPPING SYSTEM INCLUDES THE GROUNDWATER EXTRACTION AND INJECTION SYSTEM.

THE CAPITAL COSTS FOR THE AIR STRIPPING SYSTEM INCLUDE TWO AIR STRIPPING TOWERS WITH ASSOCIATED FILTERS, TANKS AND PUMPS; CONSTRUCTION EQUIPMENT AND LABOR; LAND AND SITE DEVELOPMENT; BUILDING AND UTILITIES; CONTRACTOR'S COSTS; AND ENGINEERING AND DESIGN. ANNUAL AND PERIODIC COSTS INCLUDE OPERATION AND MAINTENANCE OF THE SYSTEM. THE COSTS OF THE MONITORING PROGRAM AND THE AIR STRIPPING PROGRAM ARE LISTED BELOW:

ASSUMED LIFE OF THE ALTERNATIVE: 20 YEARS

MONITORING PROGRAM (20 YEARS)

CAPITAL COSTS:	$ 2,600
ANNUAL COSTS (SAMPLING AND ANALYSIS):	$ 27,000
PRESENT WORTH OF ANNUAL COSTS:	$ 261,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$ 263,600

AIR STRIPPING PROGRAM (8 YEARS)

CAPITAL COSTS:	$ 1,410,000
ANNUAL AND PERIODIC COSTS:	$ 223,000
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS:	$ 1,010,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$ 2,420,000

ALTERNATIVE 5 - PCE PLUME TREATMENT PLUS INCREASED PUMPING OF SACWSD WELLS

THIS ALTERNATIVE COMBINES PCE SOURCE TREATMENT (ALTERNATIVE 2) AND INCREASED PUMPING OF SACWSD WELLS. UNDER THIS ALTERNATIVE, CONTAMINATED GROUND WATER WOULD BE EXTRACTED TO CAPTURE THE PCE PLUME, TREATED BY AIR STRIPPING, AND REINJECTED, AS DESCRIBED IN ALTERNATIVE 2C. THE EXISTING AND PLANNED ACTIVITIES DESCRIBED IN ALTERNATIVE 1 ARE ALSO ASSUMED IN THIS ALTERNATIVE PLUS THE OPTION TO INITIATE BEDROCK WELL ABANDONMENT PROGRAMS. PUMPING OF THE SACWSD PRODUCTION WELLS PRESENTLY CONNECTED TO THE KLEIN WATER TREATMENT PLANT WOULD BE INCREASED AS PART OF THIS ALTERNATIVE, THEREBY ACCELERATING THE FLUSHING OF CONTAMINANTS FROM THE AQUIFER. THE EXTRA WATER WOULD BE REINJECTED IN THE SOUTHERN PORTION OF CSC OU2.

THE KLEIN WATER TREATMENT PLANT HAS THE CAPACITY TO TREAT 12 MILLION GALLONS PER DAY (MGD). THIS CAPACITY IS ONLY APPROACHED DURING THE SUMMER MONTHS (WHEN WATER DEMAND IS HIGH) AND IS SIGNIFICANTLY MORE THAN WHAT IS NEEDED DURING THE FALL, WINTER, AND SPRING. THE AVERAGE ANNUAL FLOW THROUGH THE KLEIN WATER TREATMENT PLANT IS 3.8 MGD. THIS ALTERNATIVE IS BASED ON AN INCREASE OF THE AVERAGE ANNUAL FLOW TO 4.7 MGD. THIS FLOW RATE REPRESENTS THE MAXIMUM PUMPING CAPACITY OF THE ALLUVIAL AQUIFER BASED ON GROUNDWATER MODELING. THE INCREASED PUMPING OF THE SACWSD WELLS WOULD BE LIMITED TO THOSE PORTIONS OF THE FALL, WINTER, AND SPRING MONTHS WHEN WATER DEMAND IS LOW.

DURING INCREASED PUMPING PERIODS, ALL OF THE EXTRACTED WATER WOULD BE TREATED AT THE KLEIN WATER TREATMENT PLANT AND THE EXTRA WATER WOULD BE REINJECTED IN THE SOUTHERN (UPGRADIENT) PORTION OF CSC OU2. REINJECTION OF CLEAN WATER AT THIS LOCATION WOULD AID IN FLUSHING CONTAMINATED GROUND WATER TOWARD THE SACWSD EXTRACTION WELLS. GROUNDWATER REINJECTION WOULD BE ACCOMPLISHED BY MULTIPLE INJECTION WELLS LOCATED TO AVOID DEPLETION OF THE AQUIFER. TREATED WATER WOULD BE TRANSPORTED TO THE INJECTION AREA VIA EXISTING SACWSD WATER MAINS IN THE SOUTHERN PORTION OF CSC OU2. ARARS PERTAINING TO REINJECTION OF CONTAMINATED GROUND WATER ARE IDENTICAL TO THOSE IDENTIFIED IN ALTERNATIVE NO. 2.

SOME PROBLEMS INHERENT WITH THIS ALTERNATIVE INCLUDE IMPACTS ON THE RMA CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL (POSSIBLE DIVERSION OF THE PLUMES AROUND THE IRONDALE SYSTEM CONTAINMENT), POSSIBLE DEPLETION OF THE WATER SUPPLY IN THE AQUIFER, THE VARIABILITY OF SACWSD PUMPING RATES, AND ADMINISTRATIVE CONSTRAINTS WITH RESPECT TO WATER RIGHTS. AS NOTED IN SECTION 5.3 OF THIS ROD, CONTAMINATION ON THE WESTERN TIER

OF THE ARSENAL IS PRESENT TO THE EAST OF CSC OU2 ON RMA AND IS BEING CAPTURED AND TREATED BY THE IRONDALE SYSTEM. THERE IS CONCERN THAT INCREASED PUMPING OF THE SACWSD WELLS DURING THE SUMMER MAY TEMPORARILY ALTER THE DIRECTION OF GROUNDWATER FLOW AND CAUSE THIS PLUME TO DEFLECT TO THE SOUTH AND PARTIALLY BYPASS THE IRONDALE SYSTEM. INCREASED PUMPING OF THE SACWSD WELLS DURING OTHER TIMES OF THE YEAR MAY CAUSE THE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL TO BYPASS THE IRONDALE SYSTEM ON A MORE CONSISTENT BASIS AND THEREBY CAUSE INCREASED CONTAMINATION OF THE AQUIFER IN CSC OU2. THIS SITUATION WOULD BE DETRIMENTAL, RATHER THAN BENEFICIAL TO AQUIFER REMEDIATION EFFORTS.

POSSIBLE DEPLETION OF THE AQUIFER UNDER THIS ALTERNATIVE IS ALSO OF CONCERN. IT IS BELIEVED THAT CURRENT SACWSD PUMPING RATES STRESS THE AQUIFER TO SUCH A DEGREE THAT THE LOWER PUMPING RATES IN FALL, WINTER, AND SPRING ARE NECESSARY TO ALLOW THE AQUIFER TO RECOVER FROM THE HIGH SUMMER PUMPING RATES. INCREASED PUMPING DURING LOW DEMAND PERIODS MAY NOT ALLOW SUFFICIENT AQUIFER RECOVERY, EVEN WITH REINJECTION OF THE SURPLUS WATER UPGRADIENT OF THE EXTRACTION WELLS.

AQUIFER DEPLETION COULD ALSO OCCUR IF INJECTION POINTS ARE NOT CORRECTLY LOCATED TO RETURN SURPLUS EXTRACTED WATER TO THE AREA OF THE AQUIFER FROM WHICH IT CAME. DETERMINATION OF INJECTION POINT LOCATIONS WOULD BE EXTREMELY DIFFICULT DUE TO THE PRESENCE OF PALEOCHANNELS AND VARIATIONS IN THE PERMEABILITY OF THE ALLUVIAL AQUIFER.

THE INCREASED PUMPING RATE OF 4.7 MGD WAS DEVELOPED WITH THE GROUNDWATER MODEL. WHEN THE MODEL WAS RUN USING AN AVERAGE ANNUAL EXTRACTION RATE OF 5.4 MGD, IT PREDICTED THAT SOME AREAS OF THE AQUIFER WOULD BECOME DRY. THE MODEL WAS THEN RUN AT DECREASING EXTRACTION RATES UNTIL ALL PORTIONS OF THE AQUIFER REMAINED SATURATED FOR A PERIOD OF 15 YEARS. THE HIGHEST PUMPING RATE THAT COULD BE MAINTAINED WITHOUT SIGNIFICANTLY DEPLETING THE AQUIFER WAS 4.7 MGD. IT SHOULD BE NOTED THAT THIS ANALYSIS WAS BASED ON AVERAGE ANNUAL PUMPING RATES. DAILY FLUCTUATIONS OF SACWSD PUMPING RATES MAY MAKE IT DIFFICULT TO EXTRACT AND INJECT SURPLUS WATER.

A FINAL CONSIDERATION FOR THIS ALTERNATIVE IS THE IMPACT OF WATER RIGHTS. INCREASED EXTRACTION AND SUBSEQUENT INJECTION OF SURPLUS WATER WOULD REQUIRE A REVISION OF SACWSD'S AUGMENTATION PLAN. THESE REVISIONS MUST BE MADE THROUGH THE STATE OF COLORADO WATER COURT AND CAN BECOME QUITE LENGTHY AND COSTLY, REQUIRING A MINIMUM OF THREE YEARS TO ACCOMPLISH.

THE MODEL WAS USED TO EVALUATE THE RELATIVE BENEFITS OF INCREASING THE PUMPING RATE OF SACWSD SUPPLY WELLS WHEN DEMAND IS LOW. THE MODEL RESULTS SHOWED THAT BY 2010, 66 PERCENT OF THE TCE PLUME WOULD BE REMEDIATED, AND CONCENTRATIONS WOULD BE REDUCED TO GROUNDWATER REMEDIATION LEVELS GIVEN IN TABLE 8, BEFORE MOVING OUT OF THE SACWSD WELLS AREA OF INFLUENCE. INCREASED PUMPING WOULD ALSO PULL THE PCE PLUME THROUGH THE AQUIFER FASTER THAN WITH STANDARD SACWSD PUMPING. MODELING RESULTS INDICATED THAT PCE CONCENTRATIONS WOULD BE REDUCED TO BELOW REMEDIATION LEVELS BY THE YEAR 2007.

INCREASED PUMPING ALSO REDUCES THE MAXIMUM CONCENTRATIONS OF TCE BY APPROXIMATELY 5 UG/L, ALTHOUGH IT HAS LITTLE IMPACT ON THE TIME REQUIRED TO REDUCE THE CONCENTRATION TO GROUNDWATER REMEDIATION LEVELS.

COSTS ASSOCIATED WITH THIS ALTERNATIVE ARE SUMMARIZED BELOW.

INCREASED PUMPING OF THE KLEIN WATER TREATMENT PLANT

CAPITAL COSTS:	$ 880,000
ANNUAL AND PERIODIC COSTS:	$ 602,000
PRESENT WORTH OF ANNUAL AND PERIODIC COSTS:	$ 2,700,000

TOTAL PRESENT WORTH AND CAPITAL COSTS: $ 3,580,000

TOTAL PRESENT WORTH OF AIR STRIPPING (8 YEARS) AND
INCREASED PUMPING OF THE KLEIN PLANT (20 YEARS): $ 6,000,000
(NO MONITORING)

OPERABLE UNIT 3 - RESIDENTIAL EXPOSURE TO CONTAMINATED GROUND WATER

FOR OU3, THREE ALTERNATIVES WERE EVALUATED DURING THE DETAILED ANALYSIS PHASE OF THE OU3 FS. ALL OF THESE ALTERNATIVES ADDRESS DIRECT EXPOSURE TO CONTAMINATED GROUND WATER THROUGH INGESTION AND INHALATION DURING SHOWERING. IN THE OU3 FS, THESE ALTERNATIVES ASSUMED THAT RESIDENTS ALREADY ON THE SACWSD SYSTEM WERE PROVIDED WITH DOMESTIC WATER AT CONCENTRATIONS BELOW HEALTH-BASED LEVELS (I.E. MCLS, AND PROPOSED MCLS). THIS ASSUMPTION WAS BASED ON DATA COLLECTED BY EPA AND INFORMATION PROVIDED BY SACWSD. HOWEVER, OTHER RESIDENTS STILL DIRECTLY USE UNTREATED GROUND WATER AND THEREFORE ARE AT RISK. UPON REQUEST FOR A WELL PERMIT WITHIN THE CSC SITE AREA, THE RESIDENT WOULD BE NOTIFIED BY THE COLORADO STATE ENGINEERING OFFICE OF THE POTENTIAL HEALTH RISK ASSOCIATED WITH THE CONTAMINATED GROUND WATER UNTIL GROUND WATER IS CLEANED UP TO FEDERAL AND STATE STANDARDS.

ALTERNATIVE 1 - NO ACTION

THE NO-ACTION REMEDIAL ALTERNATIVE IS REQUIRED BY THE NCP AND IS USED AS A BASELINE FOR COMPARISON OF OTHER ALTERNATIVES. THIS ALTERNATIVE REQUIRES NO FURTHER ACTION BEYOND THAT WHICH HAS ALREADY BEEN PLANNED. ACTIVITIES CURRENTLY PLANNED INCLUDE TREATMENT OF CONTAMINATED SOIL AND GROUND WATER WITHIN CSC OU1 TO ACCEPTABLE LEVELS FOR DOMESTIC USE, PREVENTION OF MIGRATION OF CONTAMINATED GROUND WATER FROM OU1 INTO OU2, AND RESTORATION OF CONTAMINATED GROUND WATER TO ACCEPTABLE LEVELS FOR DOMESTIC USE WITHIN OU2.

UNDER THIS ALTERNATIVE, RESIDENCES WITH PRIVATE ALLUVIAL WELLS AS THE SOLE SOURCE OF DOMESTIC WATER WILL BE SAMPLED AND ANALYZED FOR CHEMICALS OF CONCERN ON AN ANNUAL BASIS TO MONITOR LEVELS OF EXPOSURE.

COST ASSOCIATED WITH THIS ALTERNATIVE ARE SUMMARIZED BELOW:

NO ACTION
CAPITAL COSTS: NONE
ANNUAL OPERATION & MAINTENANCE COSTS: $21,600
TOTAL (30-YEAR PRESENT WORTH) COSTS: $332,000

ALTERNATIVE 2 - CONNECTION OF HOMES TO THE SACWSD PUBLIC WATER SYSTEM, AND INSTALLATION OF HOME ACTIVATED TREATMENT UNITS FOR HOMES NOT READILY ACCESSIBLE TO SACWSD WATER MAINS.

THIS ALTERATIVE INVOLVES CONNECTING PRIVATE ALLUVIAL WELL USERS TO THE SACWSD WATER SYSTEM. THIS ACTIVITY WOULD ENTAIL CONNECTING A SERVICE LINE FROM THE HOME TO THE WATER MAIN AND ACQUIRING A TAP FROM SACWSD. A FEE WOULD BE REQUIRED TO PURCHASE THE TAP. THIS FEE IS USED BY SACWSD FOR PURCHASE, TREATMENT, AND DISTRIBUTION OF WATER AND THE INSTALLATION OF A METER AND SHUTOFF VALVE. CURRENTLY, ALL PRIVATE ALLUVIAL WELL USERS WITHIN THE CSC SITE BOUNDARIES ARE LOCATED WITHIN THE SACWSD WATER DISTRICT AND HAVE EASY ACCESS TO SACWSD WATER MAINS.

BASED ON GROUNDWATER MODELING CONDUCTED IN THE OU2 FS, GROUNDWATER CONTAMINATION WITHIN THE CSC SITE HAS THE POTENTIAL TO CONTINUE TO ACTIVELY MIGRATE NORTHWARD PAST THE CURRENT BOUNDARIES OF THE CSC SITE. IF GROUND WATER CONTINUES TO MIGRATE NORTHWARD, MANY RESIDENTS OUTSIDE THE CURRENT SITE BOUNDARIES MAY BE EXPOSED TO CONTAMINATED WATER. RESULTS FROM THE GROUNDWATER MODELING INDICATE THAT APPROXIMATELY 20

YEARS WOULD BE REQUIRED FOR THE LAST OF THE GROUNDWATER CONTAMINANTS IN OU2 TO MIGRATE NORTH/NORTHWEST OF THE CURRENT SITE BOUNDARIES. MANY RESIDENTS OUTSIDE THE CURRENT SITE BOUNDARIES MAY NOT BE ABLE TO BE READILY CONNECTED TO THE SACWSD SYSTEM DUE TO UNAVAILABILITY OF WATER MAINS. THE UNAVAILABILITY OF WATER MAINS MAY BE ATTRIBUTED TO THE SPARSE POPULATION OF RESIDENTIAL HOMES NORTH AND NORTHWEST OF THE CURRENT CSC BOUNDARIES.

IF PRIVATE WELLS BECOME CONTAMINATED IN AREAS WHERE IT IS NOT PRACTICAL TO CONNECT USERS TO THE SACWSD SYSTEM DUE TO THE SPARSE POPULATION AND LACK OF ACCESSIBILITY TO SACWSD WATER, IT IS LIKELY THAT ACTIVATED CARBON TREATMENT UNITS WOULD BE INSTALLED TO TREAT THE CONTAMINATED GROUND WATER.

THIS ALTERNATIVE WOULD BE EFFECTIVE IN PREVENTING PRIVATE ALLUVIAL WELL USERS FROM BEING EXPOSED TO CONTAMINATED GROUND WATER. THIS ALTERNATIVE WOULD COMPLY WITH CHEMICAL-SPECIFIC ARARS. RESIDENTS WOULD BE PROVIDED WATER FROM THE SACWSD SYSTEM WHICH IS REQUIRED TO COMPLY WITH FEDERAL AND STATE REGULATION UNDER THE SAFE DRINKING WATER ACT (SDWA) AND THE PREVIOUS EPA ROD. THIS ALTERNATIVE IS CONSIDERED TO BE A PERMANENT REMEDY. IT IS TECHNICALLY AND ADMINISTRATIVELY FEASIBLE. SINCE ALL EXISTING PRIVATE ALLUVIAL WELL USERS WITH CONTAMINATION ARE LOCATED NEAR EXISTING WATER MAINS, CONNECTION TO THE SACWSD SYSTEM CAN BE QUICKLY AND EASILY ACCOMPLISHED.

COSTS FOR THIS ALTERNATIVE INCLUDE THE ACQUISITION OF A TAP, INSTALLATION OF A SERVICE LINE FROM THE HOME TO THE WATER MAIN, INSTALLATION OF A SHUT-OFF VALVE, AND INTERIOR PLUMBING FOR 12 KNOWN RESIDENCES.

COSTS ASSOCIATED WITH THIS ALTERNATIVE ARE SUMMARIZED BELOW:

CONNECTION OF RESIDENCES TO THE SACWSD WATER SYSTEM

CAPITAL COSTS:	$ 36,000
ANNUAL OPERATION & MAINTENANCE COSTS:	$ 5,520*
TOTAL (30-YEAR PRESENT WORTH) COSTS:	$ 121,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$ 157,000**

* EPA EXPECTS THE RESIDENTS TO PAY THESE EXPENSES.
** FUTURE COSTS FOR ACTIVATED CARBON TREATMENT UNITS HAVE NOT BEEN ESTIMATED.

ALTERNATIVE 3 - INDIVIDUAL HOME ACTIVATED CARBON TREATMENT UNITS

THIS ALTERNATIVE INVOLVES THE INSTALLATION OF INDIVIDUAL HOME ACTIVATED CARBON TREATMENT UNITS FOR RESIDENCES DEPENDANT ON ALLUVIAL WELLS FOR DOMESTIC PURPOSES. DOMESTIC WATER USED FOR DRINKING, COOKING, AND SHOWERING WOULD BE TREATED. IT IS ESTIMATED THAT THE CARBON WOULD BE REQUIRED TO BE REPLACED APPROXIMATELY THREE TIMES A YEAR.

THE ACTIVATED CARBON TREATMENT UNITS WOULD EFFECTIVELY TREAT THE CHEMICALS OF CONCERN EXCEPT FOR VINYL CHLORIDE. VINYL CHLORIDE HAS BEEN DETECTED SPORADICALLY THROUGHOUT THE CSC OU2 SITE. MANY OF THE CHEMICALS OF CONCERN FOR THE SITE MAY DEGRADE TO VINYL CHLORIDE UNDER ANAEROBIC CONDITIONS.

DUE TO THE POTENTIAL FOR BIODEGRADATION OF SITE CONTAMINANTS TO VINYL CHLORIDE AND TO ENSURE THAT UNITS ARE BEING REPLACED IN A TIMELY MANNER, WATER QUALITY MONITORING WOULD BE REQUIRED ON A YEARLY BASIS. THIS ALTERNATIVE WOULD NOT MEET CHEMICAL-SPECIFIC ARARS RELATED TO VINYL CHLORIDE AS PROMULGATED UNDER THE SDWA.

INDIVIDUAL HOME ACTIVATED CARBON TREATMENT UNITS

CAPITAL COSTS:	$ 24,000
ANNUAL OPERATION & MAINTENANCE COSTS:	$ 30,600
TOTAL (30-YEAR PRESENT WORTH) COSTS:	$ 370,000
TOTAL PRESENT WORTH AND CAPITAL COSTS:	$ 394,000

#SCAA

VIII. SUMMARY OF THE COMPARATIVE ANALYSIS OF ALTERNATIVES

THE REMEDIAL ALTERNATIVES DEVELOPED IN THE OU2 FS AND OU3 FS WERE ANALYZED IN DETAIL USING THE NINE EVALUATION CRITERIA OF THE NCP. THE RESULTING STRENGTHS AND WEAKNESSES OF THE ALTERNATIVES WERE THEN WEIGHED TO IDENTIFY THE ALTERNATIVE FOR EACH OU WHICH WOULD PROVIDE THE BEST BALANCE AMONG THE NINE CRITERIA. THESE CRITERIA ARE: 1) OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT; 2) COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS (ARARS); 3) REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT; 4) LONG-TERM EFFECTIVENESS AND PERMANENCE; 5) SHORT-TERM EFFECTIVENESS; 6) IMPLEMENTABILITY; 7) COST; 8) STATE ACCEPTANCE; AND 9) COMMUNITY ACCEPTANCE. EACH OF THESE CRITERIA IS DESCRIBED AND EVALUATED BELOW.

OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT ADDRESSES WHETHER OR NOT A REMEDY PROVIDES ADEQUATE PROTECTION AND DESCRIBES HOW RISKS POSED THROUGH EACH PATHWAY ARE ELIMINATED, REDUCED OR CONTROLLED.

OPERABLE UNIT 2. OVERALL PROTECTION OF HUMAN HEALTH WOULD BE ACHIEVED FOR ALL ALTERNATIVES EXCEPT ALTERNATIVE 1 (NO ACTION). ALTHOUGH OPERATION OF THE KLEIN WATER TREATMENT PLANT AND REMEDIAL ACTIVITIES UNDERTAKEN IN CSC OU3 WILL ENSURE THAT ALL RESIDENTS IN CSC OU2 ARE PROTECTED FROM CONTAMINATED GROUND WATER, THERE ARE CURRENTLY NO INSTITUTIONAL CONTROLS TO PROHIBIT FUTURE USE OF THE AQUIFER. BASED ON AN ASSESSMENT OF A REASONABLE MAXIMUM EXPOSURE SCENARIO, UNACCEPTABLE CANCER RISK OF 3 X (10-4) IS POSED TO SITE RESIDENTS. IN ADDITION, ALTERNATIVE 1 DOES NOT PROTECT THE ENVIRONMENT BECAUSE IT DOES NOT CONTROL, REMEDIATE AND PREVENT THE PCE PLUME FROM MIGRATING FURTHER INTO AND BEYOND CSC OU2 AND BECOMING MORE DISPERSED IN THE AQUIFER.

ALTERNATIVE 5 INCORPORATES THE MOST AGGRESSIVE STEPS TO REMEDIATE BOTH THE TCE AND THE PCE PLUMES, BUT IN THE PROCESS MAY CAUSE THE CONTAMINATION ON THE WESTERN TIER OF THE RMA SITE TO MOVE INTO CSC OU2. THE RESULTING MOVEMENT OF THE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL WOULD INCREASE THE AREAL EXTENT OF THE CONTAMINATION, THEREBY INCREASING THE POTENTIAL RISKS TO SITE RESIDENTS AND DISRUPTING THE REMEDIAL ACTIONS BEING TAKEN ON THE RMA SITE. THIS ALTERNATIVE MAY ALSO DEPLETE THE AQUIFER BY EXTRACTING WATER AT SUCH A RATE THAT THE AQUIFER MAY RECOVER VERY SLOWLY. BECAUSE OF THESE CONSIDERATIONS THIS ALTERNATIVE MAY NOT BE PROTECTIVE OF THE ENVIRONMENT.

ALTERNATIVE 2 IS PROTECTIVE OF THE PUBLIC HEALTH AND THE ENVIRONMENT. THIS ALTERNATIVE ADDRESSES THE PCE PLUME WITHOUT THE POSSIBILITY OF INFLUENCING THE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL, AND THEREFORE REPRESENTS THE MOST ADVANTAGEOUS APPROACH. ALL THE TREATMENT OPTIONS UNDER CONSIDERATION ARE PROTECTIVE AND RECOGNIZE THAT VINYL CHLORIDE WILL NOT BE REMOVED BY ALTERNATIVE 2A, SHOULD IT BECOME A PROBLEM.

GROUNDWATER CONTAMINATION ASSOCIATED WITH THE CSC PLUME (ALSO REFERRED TO AS THE TCE PLUME) SOUTH OF SAND CREEK WILL BE REMEDIATED BY ACTIVITIES UNDERTAKEN IN CSC OU1. SUBSEQUENT TO IMPLEMENTATION OF REMEDIAL ACTION AT OU1, GROUND WATER MIGRATING INTO OU2 FROM OU1 WILL BE BELOW LEVELS CITED IN TABLE 8. ALL OF THE ALTERNATIVES FOR CSC OU2 ADEQUATELY ADDRESS REMEDIATION OF THE TCE THAT CURRENTLY EXISTS IN CSC OU2.

OPERABLE UNIT 3. ALTERNATIVE 2 IS PROTECTIVE OF PUBLIC HEALTH. THIS

ALTERNATIVE ACHIEVES THE REMEDIAL ACTION OBJECTIVES ESTABLISHED FOR OU3 FOR ALL CHEMICALS OF CONCERN. ALTERNATIVE 1 IS NOT PROTECTIVE OF PUBLIC HEALTH. THE RESULTANT RISK ASSOCIATED WITH THIS ALTERNATIVE UNDER A RME SCENARIO IS 3 X (10-4). ALTERNATIVE 3 IS NOT AS PROTECTIVE BECAUSE THE CARBON FILTRATION UNITS WILL NOT EFFECTIVELY TREAT VINYL CHLORIDE.

COMPLIANCE WITH ARARS ADDRESSES WHETHER OR NOT A REMEDY WILL MEET ALL FEDERAL AND STATE ENVIRONMENTAL LAWS AND/OR PROVIDE GROUNDS FOR A WAIVER.

OPERABLE UNIT 2. CHEMICAL- AND ACTION-SPECIFIC ARARS FOR CSC OU2 INCLUDE REQUIREMENTS OF THE SAFE DRINKING WATER ACT, THE UNDERGROUND INJECTION CONTROL PROGRAM, THE STATE OF COLORADO WATER QUALITY CONTROL ACT, AND THE STATE OF COLORADO AIR QUALITY ACT. THESE ARARS REQUIRE THAT THE AQUIFER BE RESTORED TO DRINKING WATER QUALITY. ALTERNATIVE 1 DOES NOT COMPLY WITH THESE ARARS BECAUSE THE PCE CONCENTRATIONS IN THE AQUIFER WILL INCREASE ABOVE PROPOSED FEDERAL STANDARDS (I.E. THE PROPOSED MCL FOR PCE) IN MANY PORTIONS OF THE AQUIFER BECAUSE THE PCE PLUME WILL CONTINUE TO MIGRATE NORTHWARD. AS THE NO ACTION ALTERNATIVE DOES NOT INCLUDE TREATMENT CONTROLS, IT PROVIDES NO REDUCTION IN RISK AND WOULD NOT COMPLY WITH ARARS. THEREFORE, IT WILL NOT BE DISCUSSED FURTHER WITH REGARD TO OPERABLE UNIT 2. ALTERNATIVES UTILIZING AIR STRIPPING (ALTERNATIVE 2C), THE KLEIN WATER TREATMENT FACILITY (ALTERNATIVE 5) AND UV-OXIDATION (ALTERATIVE 2B) ARE CAPABLE OF REMOVING ALL COCS TO HEALTH BASED LEVELS AND, THEREFORE, WOULD BE IN COMPLIANCE WITH FEDERAL AND STATE UNDERGROUND INJECTION CONTROL ARARS. ALTERNATIVE 2A WOULD NOT COMPLY WITH THESE REQUIREMENTS FOR VINYL CHLORIDE. CARBON ADSORPTION (ALTERNATIVE 2A) CANNOT EFFECTIVELY TREAT VINYL CHLORIDE TO HEALTH BASED LEVELS.

OPERABLE UNIT 3. ALTERNATIVE 2 COMPLIES WITH ARARS FOR ALL CHEMICALS OF CONCERN BASED ON EXISTING SITE CONDITIONS. ALTERNATIVE 3 WOULD NOT COMPLY WITH SDWA STANDARDS FOR VINYL CHLORIDE. ALTERNATIVE 1 WOULD NOT COMPLY WITH ARARS FOR ALL CHEMICALS OF CONCERN. AS THE NO ACTION ALTERNATIVE (ALTERNATIVE 1) DOES NOT REDUCE SITE RISKS TO ACCEPTABLE LEVELS AND DOES NOT COMPLY WITH ARARS FOR CHEMICALS OF CONCERN, IT WILL NOT BE DISCUSSED FURTHER FOR OU3.

LONG-TERM EFFECTIVENESS AND PERMANENCE REFERS TO THE ABILITY OF A REMEDY TO PROVIDE RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT OVER TIME.

OPERABLE UNIT 2. ALTERNATIVES 2A, 2B, AND 2C PROVIDE PERMANENT REMEDIES FOR THE PCE PLUME. THESE ALTERNATIVES ALL PROVIDE RELIABLE PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT OF THE TCE AND PCE PLUMES AND MINIMAL RESIDUAL RISK. GROUNDWATER TREATMENT THROUGH ACTIVATED CARBON (ALTERNATIVE 2A) WOULD RESULT IN RESIDUAL WASTE MANAGEMENT OF CONTAMINANTS ADSORBED TO THE SPENT CARBON FILTERS BUT POSES A MINIMAL RESIDUAL RISK. UV OXIDATION WOULD RESULT IN NO TREATMENT RESIDUAL. RISKS ASSOCIATED WITH EMISSIONS FROM AIR STRIPPING UNDER ALTERNATIVE 2C WOULD NOT POSE AN UNACCEPTABLE RISK TO THE PUBLIC (I.E. GREATER THAN 1 X (10-6)). ALTERNATIVE 5 RESULTS IN APPROXIMATELY 5 UG/L REDUCTION IN TCE IN COMPARISON TO ALTERNATIVE 2. THIS ALTERNATIVE, HOWEVER, MAY RESULT IN THE MIGRATION OF THE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL ONTO CSC OU2, RESULTING IN AN INCREASED RISK FROM THIS PLUME.

OPERABLE UNIT 3. ALTERNATIVE 2 WOULD RESULT IN A PERMANENT REMEDY. ONCE RESIDENCES ARE CONNECTED TO SACWSD, NO ADDITIONAL ACTIVITIES WOULD BE REQUIRED. ALTERNATIVE 3 IS NOT A VERY RELIABLE ALTERNATIVE. CARBON FILTERS WOULD BE REQUIRED TO BE REPLACED APPROXIMATELY THREE TIMES PER YEAR.

REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT REFERS TO THE PREFERENCE FOR A REMEDY THAT REDUCES HEALTH HAZARDS, THE MOVEMENT OF CONTAMINANTS, OR THE QUANTITY OF CONTAMINANTS AT THE SITE.

OPERABLE UNIT 2. THE TOXICITY, MOBILITY AND VOLUME OF CONTAMINANTS WILL

DECREASE UNDER MOST ALTERNATIVES AS A RESULT OF OPERATION OF THE KLEIN WATER TREATMENT PLANT AND THE PCE TREATMENT SYSTEM. ALTERNATIVE 5 REMOVES THE GREATEST MASS OF CONTAMINATION, CLOSELY FOLLOWED BY ALTERNATIVES 2A, 2B, AND 2C. UNDER ALTERNATIVES 2C AND 5 (AIR STRIPPING), THE CONTAMINANTS REMOVED FROM THE GROUND WATER WOULD BE EMITTED TO THE ATMOSPHERE AT ACCEPTABLE EMISSION RATES ALTHOUGH THE TOXICITY, MOBILITY AND VOLUME WOULD NOT BE REDUCED. THE MOBILITY OF CONTAMINANTS TREATED THROUGH ACTIVATED CARBON (ALTERNATIVE 2A AND 5) WOULD BE REDUCED TO NEAR ZERO DURING TREATMENT. ALL ALTERNATIVES INCLUDE ACTIVATED CARBON TREATMENT BECAUSE OF OPERATION OF THE KLEIN WATER TREATMENT PLANT, AND ALTERNATIVE 2A INCLUDES AN ADDITIONAL CARBON TREATMENT SYSTEM TO TREAT THE PCE PLUME. THE MOBILITY OF THE REMOVED CONTAMINATION IS REDUCED TO NEAR ZERO WHEN IT IS ADSORBED BY THE CARBON AND SUBSEQUENTLY DESTROYED DURING CARBON REGENERATION. THE MOBILITY OF CONTAMINATION DROPS TO ZERO IN THE UV-OXIDATION PROCESS (ALTERNATIVE 2B) BECAUSE CONTAMINANTS ARE ACTUALLY DESTROYED RATHER THAN TRANSFERRED TO ANOTHER MEDIUM.

OPERABLE UNIT 3. THE TREATMENT OF CONTAMINATED GROUND WATER IS DOCUMENTED IN THE CSC OU1 AND OU2 RODS.

SHORT-TERM EFFECTIVENESS ADDRESSES THE PERIOD OF TIME NEEDED TO COMPLETE THE REMEDY, AND ANY ADVERSE EFFECTS TO HUMAN HEALTH AND THE ENVIRONMENT THAT MAY BE CAUSED DURING THE CONSTRUCTION AND IMPLEMENTATION OF THE REMEDY.

OPERABLE UNIT 2. ALL TREATMENT ALTERNATIVES PROMOTE REMEDIATION OF THE AQUIFER TO SOME DEGREE. ALTERNATIVE 5 WOULD REMEDIATE THE AQUIFER MOST QUICKLY AND WOULD REMOVE THE GREATEST MASS OF CONTAMINATION (92 PERCENT OF THE PCE) BY REMEDIATING THE PCE PLUME AND INCREASING THE AMOUNT OF GROUND WATER BEING TREATED BY THE KLEIN WATER TREATMENT PLANT. IT IS ESTIMATED THAT THE PCE PLUME WOULD BE REMEDIATED IN 17 YEARS AND THE TCE PLUME WOULD APPROACH REMEDIATION LEVELS IN 25 YEARS. THIS ALTERNATIVE, HOWEVER, HAS THE POTENTIAL TO INDUCE MIGRATION OF THE CONTAMINATION ON THE WESTERN TIER OF RMA INTO CSC OU2, WHICH WOULD HAVE A DETRIMENTAL EFFECT ON GROUNDWATER QUALITY IN CSC OU2. IN ADDITION, ALTERNATIVE 5 MAY RESULT IN AQUIFER DEPLETION, WHICH IS UNACCEPTABLE BECAUSE THIS AQUIFER IS THE PRINCIPAL SOURCE OF WATER FOR COMMERCE CITY.

ALTERNATIVES 2A AND 2C PROVIDE THE GREATEST DEGREE OF SHORT-TERM EFFECTIVENESS. DESPITE THE FACT THAT THESE ALTERNATIVES REQUIRE SLIGHTLY MORE TIME TO REMEDIATE THE AQUIFER THAN ALTERNATIVE 5, THEY WILL NOT IMPACT WATER AVAILABILITIES OR THE CONTAMINATION ON THE WESTERN TIER OF RMA. ALTERNATIVE 2B WOULD REQUIRE CONDUCTING PILOT AND TREATABILITY TESTS TO OPTIMIZE TREATMENT. THIS WOULD RESULT IN A DELAY IN FINALIZING REMEDIAL DESIGN PLANS AND INITIATING REMEDIAL ACTION. APPROXIMATELY 86 PERCENT OF THE PCE PLUME WOULD BE REMOVED BY ALTERNATIVES 2A, 2B, AND 2C AND REMEDIATION TIMES ARE ESTIMATED TO BE 20 YEARS FOR PCE AND 30 YEARS FOR TCE. FIELD AND CONSTRUCTION ACTIVITIES ASSOCIATED WITH ALL OF THESE ALTERNATIVES WOULD NOT IMPACT HUMAN HEALTH OR THE ENVIRONMENT DURING ALTERNATIVE IMPLEMENTATION. THE ADVERSE IMPACT FROM EMISSIONS TO THE ATMOSPHERE OF ALTERNATIVES 2C AND 5 IS JUDGED ACCEPTABLE BY FEDERAL AND STATE REQUIREMENTS AND EPA POLICY.

OPERABLE UNIT 3. BOTH ALTERNATIVE 2 AND ALTERNATIVE 3 CAN BE IMPLEMENTED VERY QUICKLY (I.E., LESS THAN 30 DAYS).

IMPLEMENTABILITY REFERS TO THE TECHNICAL AND ADMINISTRATIVE FEASIBILITY OF A REMEDY. THIS INCLUDES THE AVAILABILITY OF MATERIALS AND SERVICES NEEDED TO CARRY OUT A REMEDY. IT ALSO INCLUDES COORDINATION OF FEDERAL, STATE, AND LOCAL GOVERNMENTS TO CLEAN UP THE SITE.

OPERABLE UNIT 2. ALTERNATIVE 2 IS THE EASIEST TO IMPLEMENT AS INSTALLATION OF PUMP AND TREAT SYSTEMS IS COMMONLY PERFORMED ON SIMILAR

SITES. WITHIN THE TREATMENT OPTIONS, CARBON ADSORPTION AND AIR STRIPPING WILL BE EASIER TO IMPLEMENT THAN UV-OXIDATION, WHICH WOULD REQUIRE EXTENSIVE TREATABILITY AND PILOT TESTING. FINALLY, ALTERNATIVE 5 IS THE MOST DIFFICULT TO IMPLEMENT BECAUSE SACWSD WOULD BE REQUIRED TO REVISE ITS WATER AUGMENTATION PLAN AND TO REQUEST APPROVAL FROM THE STATE OF COLORADO WATER COURT, WHICH WOULD REQUIRE AT A MINIMUM 3 YEARS. IN ADDITION, TECHNICAL CONSIDERATIONS, PRIMARILY DEPLETION OF THE AQUIFER, MAY PREVENT THIS ALTERNATIVE FROM BEING TECHNICALLY IMPLEMENTABLE. INCREASED PUMPING OF THE SACWSD EXTRACTION WELLS AND THE POTENTIAL FOR MISPLACED REINJECTION POINTS COULD RESULT IN AQUIFER DEPLETION. THEREFORE THIS ALTERNATIVE IS ALSO DIFFICULT TO IMPLEMENT FROM A TECHNICAL STANDPOINT.

OPERABLE UNIT 3. ALTERNATIVE 2 AND ALTERNATIVE 3 ARE READILY IMPLEMENTABLE.

COST EVALUATES THE ESTIMATED CAPITAL AND OPERATION AND MAINTENANCE COSTS OF EACH ALTERNATIVE IN COMPARISON TO OTHER EQUALLY PROTECTIVE ALTERNATIVES.

OPERABLE UNIT 2. THE ALTERNATIVE WITH THE GREATEST CAPITAL COST IS ALTERNATIVE 5 ($3,290,000), PCE PLUME TREATMENT WITH INCREASED PUMPING OF THE SACWSD WELLS. THE TREATMENT OPTION WITH THE GREATEST CAPITAL COST IS UV-OXIDATION ($1,950,000), FOLLOWED BY CARBON ADSORPTION ($1,910,00) (ALTERNATIVE 2B AND 2A RESPECTIVELY). ALTERNATIVE 2C, AIR STRIPPING HAS THE LOWEST CAPITAL COSTS ($1,410,000). THE ALTERNATIVE WITH THE GREATEST OPERATION AND MAINTENANCE (O&M) COSTS IS ALSO ALTERNATIVE 5, AND O&M COSTS ARE ALSO GREATEST FOR UV-OXIDATION, FOLLOWED BY CARBON ADSORPTION, AND AIR STRIPPING (ALTERNATIVES 2B, 2A, AND 2C, RESPECTIVELY). THE PRESENT WORTH OF THE ALTERNATIVES VARIES IN THE SAME MANNER AS CAPITAL AND O&M COSTS. SPECIFIC CAPITAL, O & M, AND PRESENT WORTH COSTS FOR ALTERNATIVES 2A, 2B, 2C AND 5 ARE PRESENTED IN TABLE 9.

OPERABLE UNIT 3. BASED ON PRESENT WORTH COST CALCULATIONS, ALTERNATIVE 2 IS APPROXIMATELY THREE TIMES LESS COSTLY THANALTERNATIVE 3 BECAUSE ADDITIONAL MONITORING WOULD BE REQUIRED FOR ALTERNATIVE 3. THE CAPITAL COSTS FOR ALTERNATIVE 2 ARE APPROXIMATELY $36,000. THE CAPITAL COST FOR ALTERNATIVE 3 IS SLIGHTLY LESS AT $24,000. ALTERNATIVE 2, HOWEVER, REQUIRES NO O & M COSTS, COMPARED TO $30,000 PER YEAR UNDER ALTERNATIVE 3, SINCE MONITORING WOULD NOT BE REQUIRED FOR ALTERNATIVE 2.

SPECIFIC CAPITAL, O & M AND PRESENT WORTH COSTS FOR ALTERNATIVE 2 AND ALTERNATIVE 3 ARE PRESENTED IN TABLE 10.

STATE ACCEPTANCE INDICATES WHETHER THE STATE AGREES WITH, OPPOSES, OR HAS NO COMMENT ON THE PREFERRED ALTERNATIVE.

OPERABLE UNIT 2. EPA HAS INVOLVED THE COLORADO DEPARTMENT OF HEALTH (CDH) THROUGHOUT THE RI/FS AND REMEDY SELECTION PROCESS. CDH WAS PROVIDED THE OPPORTUNITY TO COMMENT ON THE RI/FS DOCUMENT AND THE PROPOSED PLAN AND TOOK PART IN THE PUBLIC MEETING HELD TO INFORM THE PUBLIC OF THE PROPOSED PLAN. CDH SUBMITTED FORMAL COMMENTS TO EPA DURING THE PUBLIC COMMENT PERIOD FOR OU2. IN THESE COMMENTS, CDH IDENTIFIED ADDITIONAL STATE ARARS WHICH WERE NOT INCLUDED IN THE OU2 FS. PRIOR TO PUBLIC RELEASE OF THE OU2 PROPOSED PLAN, THE STATE OF COLORADO (CDH) INFORMED EPA IN WRITING THAT THE STATE CONCURS WITH EPA'S PREFERRED ALTERNATIVE, ALTERNATIVE 2C. APPENDIX C CONTAINS THE STATE'S LETTER OF CONCURRENCE WITH THESE RODS.

OPERABLE UNIT 3. SIMILAR TO OPERABLE UNIT 2, CDH WAS PROVIDED THE OPPORTUNITY TO COMMENT ON THE RI/FS DOCUMENT AND PROPOSED PLAN FOR OPERABLE UNIT 3. CDH SUBMITTED FORMAL COMMENTS TO EPA DURING THE PUBLIC COMMENT PERIOD FOR OU3. IN THESE COMMENTS, CDH REQUESTED CLARIFICATION REGARDING THE IDENTIFICATION OF SPECIFIC RESIDENCES REQUIRING CONNECTION

TO SACWSD. RESPONSES TO THESE SPECIFIC CONCERNS ARE PROVIDED IN THE RESPONSIVENESS SUMMARY SECTION OF THE ROD. PRIOR TO PUBLIC RELEASE OF THE OU3 PROPOSED PLAN, THE STATE OF COLORADO INFORMED EPA IN WRITING THAT THE STATE CONCURS WITH EPA'S PREFERRED ALTERNATIVE, ALTERNATIVE 2. APPENDIX C CONTAINS THE STATE'S LETTER OF CONCURRENCE WITH THESE RODS.

COMMUNITY ACCEPTANCE INCLUDES DETERMINING WHICH COMPONENTS OF THE ALTERNATIVES INTERESTED PERSONS IN THE COMMUNITY SUPPORT, HAVE RESERVATIONS ABOUT, OR OPPOSE.

OPERABLE UNIT 2. EPA SOLICITED INPUT FROM THE COMMUNITY ON THE CLEANUP METHODS PROPOSED FOR GROUND WATER AT CSC OU2. ONE CITIZENS' GROUP, CITIZENS AGAINST CONTAMINATION (CAC), SUBMITTED FORMAL COMMENTS TO EPA DURING THE PUBLIC COMMENT PERIOD. IN THEIR COMMENTS, THEY INDICATED THAT THEY WERE OPPOSED TO THE LACK OF EMISSION CONTROLS ON THE AIR STRIPPING UNIT PROPOSED UNDER ALTERNATIVE 2C. THIS CONCERN IS ADDRESSED IN THE RESPONSIVENESS SUMMARY SECTION OF THIS ROD.

OPERABLE UNIT 3. CONCERNS WERE RAISED BY THE SOUTH ADAMS COUNTY WATER AND SANITATION DISTRICT (SACWSD) REGARDING THE ACCEPTABILITY OF WATER FROM WELL #18. SACWSD PROVIDED EPA WITH ADDITIONAL DATA ON THE WATER QUALITY FOR WELL #18. THESE DATA INDICATED THAT CONCENTRATIONS OF TCE ROUTINELY FLUCTUATED ABOVE THE MCL OF 5 UG/L. THE HIGHEST READING OF TCE WAS 12 UG/L. SACWSD WOULD PREFER THAT THE SELECTED REMEDY INCLUDE PROVISIONS FOR TREATMENT OF WATER FROM WELL #18. THESE CONCERNS ARE ADDRESSED IN THE RESPONSIVENESS SUMMARY.

#SR
IX. SELECTED REMEDY

EPA HAS SELECTED CSC OU2 ALTERNATIVE 2C, PCE PLUME TREATMENT BY AIR STRIPPING WITH HYDRAULIC CONTAINMENT AND STANDARD PUMPING OF SACWSD WELLS, AND CSC OU3 ALTERNATIVE 2, CONNECTION OF HOMES TO THE SACWSD WATER SYSTEM AS THE REMEDIES FOR CHEMICAL SALES OPERABLE UNIT 2 AND OPERABLE UNIT 3. THE REMEDY ASSUMES CONTINUED OPERATION OF THE KLEIN TREATMENT PLANT.

THE REMEDY FOR OPERABLE UNIT 2 IS MADE UP OF THE FOLLOWING COMPONENTS:

* EXTRACTION OF CONTAMINATED GROUND WATER BY EXTRACTION WELLS
* TREATMENT OF CONTAMINATED GROUND WATER BY AIR STRIPPING
* REINJECTION OF TREATED WATER TO THE AQUIFER BY INJECTION WELLS

THIS REMEDY ALSO INCLUDES:

* MONITORING OF APPROXIMATELY 15 WELLS ON AT LEAST AN ANNUAL BASIS
* VOLUNTARY ABANDONMENT OF BEDROCK WELLS FOR WHICH CRITERIA WILL BE ESTABLISHED IN RD

THE GROUND WATER EXTRACTION SYSTEM WILL BE INSTALLED TO EXTRACT THE MAXIMUM AMOUNT OF THE PCE PLUME POSSIBLE. THE CONFIGURATION OF THE EXTRACTION AND INJECTION WELLS WILL BE DETERMINED DURING REMEDIAL DESIGN. THE SYSTEM WILL OPERATE UNTIL CONTAMINANT CONCENTRATIONS ARE REDUCED TO SITE REMEDIATION LEVELS CITED IN TABLE 8.

THIS ALTERNATIVE ASSUMES THAT THE REMEDIAL ACTION OBJECTIVES FOR CSC OU1 AND CSC OU3 WILL BE MET. THUS, CONTAMINATED GROUND WATER WILL BE PREVENTED FROM ENTERING OU2 FROM OU1, AND USERS OF SHALLOW ALLUVIAL WELLS IN OU2 WILL BE PROTECTED. ESTIMATED COST FOR THE SELECTED REMEDY IS $2,683,600 (INCLUDES COST OF MONITORING).

THE REMEDY FOR OPERABLE UNIT 3 CONSISTS OF THE FOLLOWING COMPONENTS:

* CONNECTION OF RESIDENCES CURRENTLY USING ALLUVIAL WELLS FOR DOMESTIC WATER TO THE SACWSD. CURRENTLY, ALL KNOWN SITE RESIDENCES CAN BE READILY CONNECTED TO SACWSD WATER.

* INSTALLATION OF HOME ACTIVATED CARBON UNITS FOR HOMES NOT READILY ACCESSIBLE TO SACWSD. MONITOR FOR VINYL CHLORIDE TO ENSURE PROTECTION OF REMEDY.

* NOTIFICATION OF POTENTIAL HEALTH TREAT.

THE SELECTION OF THESE REMEDIES IS BASED UPON THE COMPARATIVE ANALYSIS OF ALTERNATIVES PRESENTED IN THE PREVIOUS SECTION. THESE REMEDIES PROVIDE THE BEST BALANCE WITH RESPECT TO THE NINE EVALUATION CRITERIA, ARE PROTECTIVE OF BOTH HUMAN HEALTH AND THE ENVIRONMENT, AND WILL COMPLY WITH ALL IDENTIFIED STATE AND FEDERAL ARARS.

OPERABLE UNIT 2

THE SELECTED REMEDIAL ALTERNATIVE (ALTERNATIVE 2C) FOR OPERABLE UNIT 2 ADDRESSES THE PCE PLUME WITHOUT INFLUENCING THE CONTAMINATION ON THE WESTERN TIER OF RMA. AIR STRIPPING TECHNOLOGY IS THE MOST EFFECTIVE AND IMPLEMENTABLE TECHNOLOGY FOR REMOVING ALL THE COCS IDENTIFIED FOR OU2. VOC EMISSIONS RESULTING FROM AIR STRIPPING OPERATIONS WILL RESULT IN MINIMAL RISK (I.E. LESS THAN 1 X (10-6) RISK LEVEL). THE SOURCE OF THE CHEMICAL SALES CO. PLUME (ALSO REFERRED TO AS THE TCE PLUME) WILL BE REMEDIATED BY ACTIVITIES UNDERTAKEN IN CSC OU1. THESE ACTIVITIES WILL RESULT IN A SIGNIFICANT REDUCTION IN THE MASS OF ALLUVIAL AQUIFER CONTAMINATION WITHIN OU1. IN ADDITION, GROUNDWATER CONTAMINANTS WITHIN OU1 WILL BE PREVENTED FROM MIGRATING INTO OU2. THESE ACTIONS ARE CONSIDERED TO BE SUFFICIENT WITH REGARD TO ADDRESSING GROUNDWATER CONTAMINATION EMANATING FROM THE CSC FACILITY.

ALTERNATIVE 2C WAS SELECTED OVER ALTERNATIVE 5 DUE TO ADMINISTRATIVE AND TECHNICAL IMPLEMENTABILITY PROBLEMS ASSOCIATED WITH ALTERNATIVE 5. THESE CONCERNS INCLUDE: (1) A DELAY IN INITIATING REMEDIAL ACTION RESULTING FROM ADMINISTRATIVE DIFFICULTIES IN OBTAINING THE COLORADO STATE ENGINEER'S OFFICE APPROVAL FOR SACWSD WATER AUGMENTATION PLAN REVISION; (2) POTENTIAL DEPLETION OF THE ALLUVIAL AQUIFER WHICH IS THE PRIMARY SOURCE OF WATER TO THE RESIDENTS OF COMMERCE CITY; AND, (3) POSSIBLE MIGRATION OF THE RMA CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL INTO OU2. ALTHOUGH ALTERNATIVE 5 WOULD RESTORE THE ALLUVIAL AQUIFER WITHIN OU2 FASTER THAN ALTERNATIVE 2, ALTERNATIVE 5 WAS NOT SELECTED DUE TO THE IMPLEMENTABILITY CONCERNS LISTED ABOVE.

AIR STRIPPING WAS SELECTED AS THE MOST APPROPRIATE TREATMENT TECHNOLOGY BECAUSE IT IS THE MOST EFFECTIVE TECHNOLOGY TO TREAT CSC OU2 COCS, IS READILY IMPLEMENTABLE AND IS THE LEAST COSTLY TREATMENT TECHNOLOGY. DESPITE THE FACT THAT UV-OXIDATION REDUCES THE MOBILITY OF CONTAMINANTS MORE EFFECTIVELY THAN AIR STRIPPING AND IS PERMANENT, THIS TECHNOLOGY IS MORE COSTLY THAN AIR STRIPPING AND WOULD REQUIRE EXTENSIVE TESTING TO DETERMINE APPROPRIATE ADJUSTMENTS FOR TREATMENT.

UNDER ALTERNATIVE 2C, THE TOXICITY AND VOLUME OF CONTAMINANTS WILL DECREASE AS A RESULT OF OPERATING THE KLEIN WATER TREATMENT PLANT AND THE PCE TREATMENT SYSTEM. APPROXIMATELY 86 PERCENT OF THE PCE PLUME WILL BE REMOVED BY THIS ALTERNATIVE. REMEDIATION TIMES ARE ESTIMATED TO BE 20 YEARS FOR PCE AND 30 YEARS FOR TCE. THIS ALTERNATIVE WILL NOT RESULT IN UNACCEPTABLE RISKS TO THE COMMUNITY DURING IMPLEMENTATION.

THE SELECTION OF THIS ALTERATIVE (ALTERNATIVE 2C) IS IN KEEPING WITH EPA POLICY TO ACT QUICKLY AND CAPTURE AS MUCH OF THE PLUME AS POSSIBLE,

BEFORE IT DILUTES AND DISPERSES IN THE AQUIFER. EXPERIENCE HAS SHOWN THAT PREVENTING FURTHER MIGRATION OF CONTAMINATION IS AN ESSENTIAL OBJECTIVE FOR ANY AQUIFER REMEDIATION EFFORT. THE MONITORING PORTION OF THIS ALTERNATIVE FURTHER REFLECTS EPA'S POLICY THAT DATA SHOULD CONTINUE TO BE COLLECTED AT A SITE TO ASSESS CONTAMINANT MOVEMENT AND PREDICT THE LIKELY RESPONSE TO EXTRACTION. THIS ALTERNATIVE WILL MEET THE REMEDIAL ACTION GOALS AND OBJECTIVES FOR GROUND WATER IN CSC OU2 OUTLINED IN SECTION VII OF THIS ROD.

REMEDIATION GOALS AND PERFORMANCE STANDARDS FOR GROUND WATER

REMEDIAL ACTION OBJECTIVES. REMEDIAL ACTION OBJECTIVES FOR THIS SITE ARE PRESENTED IN TABLE 8

AREA OF ATTAINMENT. THE AREA OF ATTAINMENT FOR THE GROUND WATER REMEDIATION SHALL BE THE CSC OU2 PLUMES EXCEEDING GROUND WATER REMEDIATION LEVELS FOR ALL COCS. LOW-LEVEL CONTAMINATION NOT CAPTURED BY THE SACWSD PUMPING WELLS WILL BE ALLOWED TO FLOW TO THE NORTH AND NORTHWEST, AND ANY USERS OF WATER EXCEEDING ACCEPTABLE CONTAMINANT CONCENTRATION LEVELS AS DEFINED IN TABLE 8, WILL BE PROVIDED WITH ALTERNATE WATER UNDER OU3. THE ESTIMATED AREA THAT CURRENTLY EXCEEDS REMEDIATION LEVELS IS SHOWN ON FIGURES 6 AND 7. THE TCE AND PCE PLUME AREAS SHOWN IN FIGURES 6 AND 7 CURRENTLY INCLUDE ALL AREAS WHERE OTHER COCS EXCEED THEIR RESPECTIVE REMEDIATION LEVELS. THIS AREA MAY BE REVISED BASED ON WATER QUALITY SAMPLING DURING RD/RA.

RESTORATION TIME FRAME. THE RESTORATION TIME FRAME FOR THIS REMEDIAL ACTION IS ESTIMATED TO BE APPROXIMATELY 20 YEARS FOR THE PCE PLUME AND 30 YEARS FOR THE TCE PLUME.

PERFORMANCE STANDARDS. SPECIFIC PERFORMANCE STANDARDS, USED TO ENSURE ATTAINMENT OF THE REMEDIAL ACTION OBJECTIVES FOR GROUND WATER ARE:

1. REDUCE CONTAMINANT CONCENTRATIONS IN GROUND WATER WITHIN THE AREA OF ATTAINMENT TO THE REMEDIATION LEVELS SPECIFIED IN TABLE 8 AND TO LEVELS WHICH PRESENT A TOTAL CARCINOGENIC RISK OF LESS THAN (10-4) TO (10-6).

2. ENSURE CAPTURE OF THE PCE PLUME WITHIN THE AREA OF ATTAINMENT. VERIFY THAT PLUME MOVEMENT IS BEING CONTROLLED BY MEASURING HYDRAULIC GRADIENT WITHIN AND OUTSIDE OF THE PLUME, AND DEMONSTRATING THAT THE GRADIENT IS INWARD TOWARD THE PUMPING WELLS.

3. MEET ALL ARARS IDENTIFIED IN THIS ROD FOR THE REMEDIATION OF GROUND WATER, INCLUDING REQUIREMENTS FOR AIR EMISSIONS MONITORING AND UIC REQUIREMENTS FOR REINJECTION OF GROUND WATER.

4. THE REMEDIAL ACTION SHALL BE CONSIDERED COMPLETE AFTER THE REMEDIATION LEVELS HAVE BEEN MAINTAINED IN ALL COMPLIANCE MONITORING WELLS FOR FOUR YEARS.

THE EXTRACTION SYSTEM SHALL CONTINUE TO OPERATE UNTIL REMEDIATION LEVELS HAVE BEEN MAINTAINED IN ALL COMPLIANCE MONITORING WELLS FOR FOUR CONSECUTIVE QUARTERS OF SAMPLING.

AFTER THAT TIME, GROUND WATER EXTRACTION MAY BE TERMINATED UPON APPROVAL BY EPA. THE REMEDIATION LEVELS MUST THEN BE MET FOR THREE ADDITIONAL YEARS (WITH A SAMPLING FREQUENCY TO BE DETERMINED DURING RD/RA, BUT EXPECTED TO BE QUARTERLY), AFTER WHICH THE REMEDIAL ACTION MAY BE CONSIDERED COMPLETE. AFTER THE REMEDIAL ACTION IS COMPLETE, THERE MAY BE ADDITIONAL MONITORING CONDUCTED BY EPA. IF ANY EXCEDENCE OF THE

PERFORMANCE STANDARDS OCCURS IN ANY OF THE COMPLIANCE MONITORING WELLS DURING THIS THREE-YEAR PERIOD, THE EXTRACTION AND TREATMENT SYSTEM SHALL BE RESTARTED AND OPERATED UNTIL PERFORMANCE STANDARDS ARE AGAIN ATTAINED IN ALL COMPLIANCE MONITORING WELLS. THIS CYCLE SHALL CONTINUE UNTIL QUARTERLY MONITORING FOR ONE YEAR DEMONSTRATES NO EXCEDENCE OF PERFORMANCE STANDARDS IN THE COMPLIANCE MONITORING WELLS.

THE WELLS TO BE USED FOR COMPLIANCE MONITORING FOR WATER QUALITY AND WATER LEVELS WILL BE APPROVED BY EPA DURING REVIEW OF THE 60 PERCENT REMEDIAL DESIGN COMPLETION REPORT, AND WILL, AT A MINIMUM, INCLUDE WELLS UPGRADIENT OF THE PLUMES, WITHIN THE PLUMES, AROUND THE PLUMES, AND DOWNGRADIENT OF THE PLUMES. ANY STATISTICAL METHODS TO AVERAGE WELL CONCENTRATIONS SHALL BE SPECIFIED DURING RD/RA.

THE FIRST REMEDIAL ACTION OBJECTIVE, STATED ABOVE, IS TO RESTORE GROUND WATER TO ITS BENEFICIAL USE AS A DRINKING WATER AQUIFER. BASED ON INFORMATION OBTAINED DURING THE REMEDIAL INVESTIGATION AND A CAREFUL ANALYSIS OF ALL REMEDIAL ALTERNATIVES, EPA AND THE STATE OF COLORADO BELIEVE THAT THE SELECTED REMEDY WILL ACHIEVE THIS OBJECTIVE. IT MAY BECOME APPARENT, HOWEVER, DURING IMPLEMENTATION OR OPERATION OF THE GROUND WATER EXTRACTION SYSTEMS AND THEIR MODIFICATIONS, THAT CONTAMINANT LEVELS HAVE CEASED TO DECLINE OR ARE REMAINING CONSTANT AT LEVELS HIGHER THAN THE REMEDIATION GOAL OVER SOME PORTION OF THE CONTAMINATED PLUMES. IN SUCH A CASE, EITHER OR BOTH OF THE EXTRACTION SYSTEMS' PERFORMANCE STANDARDS AND/OR REMEDY MAY BE REEVALUATED. IF NEW EXTRACTION OR REMEDIATION TECHNOLOGIES BECOME AVAILABLE IN THE FUTURE WHICH WOULD SIGNIFICANTLY IMPROVE THE REMEDIATION PROCESS (ALLOW ATTAINMENT OF REMEDIATION LEVELS WHICH WERE NOT PREVIOUSLY ATTAINABLE, OR EXPEDITE THE CLEANUP), THE REMEDY WILL BE REEVALUATED IN LIGHT OF THE NEW INFORMATION.

THE SELECTED REMEDY WILL INCLUDE GROUND WATER EXTRACTION FOR AN ESTIMATED PERIOD OF APPROXIMATELY 20 YEARS FOR THE PCE PLUME AND 30 YEARS FOR THE TCE PLUME, DURING WHICH TIME THE TWO SYSTEMS' PERFORMANCE WILL BE CAREFULLY MONITORED ON A REGULAR BASIS AND ADJUSTED AS WARRANTED BY THE PERFORMANCE DATA COLLECTED DURING OPERATION. MODIFICATIONS MAY INCLUDE ANY OR ALL OF THE FOLLOWING:

A. AT INDIVIDUAL WELLS WHERE CLEANUP GOALS HAVE BEEN ATTAINED, PUMPING MAY BE DISCONTINUED;

B. ALTERNATING PUMPING AT WELLS TO ELIMINATE STAGNATION POINTS;

C. PULSE PUMPING TO ALLOW AQUIFER EQUILIBRATION AND TO ALLOW ADSORBED CONTAMINANTS TO PARTITION INTO GROUND WATER; AND

D. INSTALLING ADDITIONAL EXTRACTION WELLS TO FACILITATE OR ACCELERATE CLEANUP OF THE CONTAMINANT PLUME.

TO ENSURE THAT REMEDIATION LEVELS ARE MAINTAINED AT THOSE WELLS WHERE PUMPING HAS CEASED, THOSE WELLS WILL BE MONITORED EVERY YEAR FOLLOWING DISCONTINUATION OF GROUNDWATER EXTRACTION, UNTIL THE REMEDIAL ACTION IS COMPLETED.

PERFORMANCE AND COMPLIANCE SAMPLING PROGRAM. A SAMPLING PROGRAM FOR MONITORING THE REMEDIAL ACTION PERFORMANCE AND FOR DETERMINING COMPLIANCE WITH THE PERFORMANCE STANDARDS SHALL BE IMPLEMENTED DURING THE REMEDIAL ACTION. THIS PROGRAM WILL BE DEVELOPED DURING REMEDIAL DESIGN AND SHALL INCLUDE, AT A MINIMUM, THE FOLLOWING: LOCATIONS OF PERFORMANCE AND COMPLIANCE MONITORING WELLS FOR WATER QUALITY SAMPLING, FREQUENCY OF MONITORING OF PERFORMANCE AND COMPLIANCE WELLS, ANALYTICAL PARAMETERS (FOCUSING ON COCS WITH POSSIBLE USE OF INDICATOR CHEMICALS), SAMPLING FIELD METHODS, WATER LEVEL MEASUREMENT FREQUENCY, ANALYTICAL

METHODS FOR CHEMICAL ANALYSIS (WITH POSSIBLE USE OF NON-CLP ANALYSIS), LOCATIONS AND METHODS FOR WATER LEVEL MEASUREMENT, AND STATISTICAL METHODS FOR EVALUATING DATA. THE PERFORMANCE AND COMPLIANCE SAMPLING PROGRAM WILL BE SPECIFIED IN THE RA WORKPLAN AND MAY BE MODIFIED DURING THE RA.

THE PERFORMANCE MONITORING SYSTEM WILL BE DESIGNED TO PROVIDE INFORMATION THAT CAN BE USED TO EVALUATE THE EFFECTIVENESS OF THE REMEDIAL ACTION WITH RESPECT TO THE FOLLOWING:

* HORIZONTAL AND VERTICAL EXTENT OF THE PLUME AND CONTAMINANT CONCENTRATION GRADIENTS, INCLUDING A MASS BALANCE CALCULATION, IF POSSIBLE
* RATE AND DIRECTION OF CONTAMINANT MIGRATION
* CHANGES IN CONTAMINANT CONCENTRATIONS OR DISTRIBUTION OVERTIME
* EFFECTS OF ANY MODIFICATIONS TO THE ORIGINAL REMEDIAL ACTION.

OTHER ITEMS TO BE SPECIFIED IN THE PERFORMANCE MONITORING PLAN INCLUDE:

* MONITORING OF CONCENTRATIONS OF INFLUENT AND EFFLUENT TO THE PCE PLUME AIR STRIPPER (INFLUENT WATER CONCENTRATION, AND EFFLUENT WATER AND AIR CONCENTRATIONS), SO AS TO MEET AIR EMISSION STANDARDS.

* CONCENTRATIONS OF CONTAMINANTS IN GROUND WATER TO BE REINJECTED, SO AS TO COMPLY WITH UIC REQUIREMENTS FOR REINJECTED GROUND WATER.

* METHODS TO MONITOR POSSIBLE MIGRATION OF CONTAMINANTS TO THE NORTH AND NORTHWEST OF THE MAIN SACWSD PUMPING CENTER.

OPERABLE UNIT 3

FOR CSC OU3, CONTINUED OPERATION OF THE KLEIN WATER TREATMENT PLANT (KWTP) AND CONNECTION OF ALLUVIAL WELL USERS TO THE SACWSD WATER SYSTEM WILL ENSURE THAT ALL RESIDENTS IN CSC OU2 ARE PROTECTED FROM EXPOSURE TO CONTAMINATED GROUND WATER. ALTERNATIVE 2 WAS SELECTED OVER ALTERNATIVE 3 BECAUSE IT REPRESENTS A PERMANENT REMEDY, IS LESS COSTLY THAN ALTERNATIVE 3, AND IS PROTECTIVE OF HUMAN HEALTH FOR ALL COCS. ALTERNATIVE 3 REQUIRES THAT HOME CARBON FILTERS BE CHANGED ABOUT THREE TIMES A YEAR AND WOULD NOT BE EFFECTIVE IN TREATING VINYL CHLORIDE.

VINYL CHLORIDE HAS NOT BEEN DETECTED IN GROUND WATER EXTRACTED BY THE SACWSD MUNICIPAL SUPPLY WELLS. IF VINYL CHLORIDE IS DETECTED AT THE KLEIN WATER TREATEMENT FACILITY, IT WILL BE TREATED THROUGH AIR STRIPPING UNDER THE PROVISIONS OF THE EPA OFF-POST RMA OU1 RECORD OF DECISION.

#SD
X. STATUTORY DETERMINATIONS

EPA'S PRIMARY RESPONSIBILITY AT CERCLA SITES IS TO SELECT REMEDIAL ACTIONS THAT ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT. CERCLA ALSO REQUIRES THAT THE SELECTED REMEDIAL ACTION FOR THE SITE COMPLY WITH APPLICABLE OR RELEVANT AND APPROPRIATE ENVIRONMENTAL STANDARDS ESTABLISHED UNDER FEDERAL AND STATE ENVIRONMENTAL LAWS, UNLESS A WAIVER IS GRANTED. THE SELECTED REMEDY MUST ALSO BE COST-EFFECTIVE AND UTILIZE PERMANENT TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE. THE STATUTE ALSO CONTAINS A PREFERENCE FOR REMEDIES THAT INCLUDE TREATMENT AS A PRINCIPAL ELEMENT. THE FOLLOWING SECTIONS DISCUSS HOW THE SELECTED REMEDIES FOR CSC OU2 AND CSC OU3 MEET THESE STATUTORY REQUIREMENTS.

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

OPERABLE UNIT 2. IN ORDER TO MEET THE REMEDIAL OBJECTIVES OUTLINED IN THE PREVIOUS SECTION, THE RISK ASSOCIATED WITH EXPOSURE TO THE CONTAMINATED GROUND WATER MUST FALL WITHIN THE ACCEPTABLE RISK FOR CARCINOGENS. ATTAINMENT OF MCLS AND PROPOSED MCLS WILL ASSURE SITE RISK FALLS WITHIN THIS RANGE. THE SELECTED REMEDY PROTECTS HUMAN HEALTH AND THE ENVIRONMENT BY REDUCING LEVELS OF CONTAMINANTS IN THE GROUND WATER THROUGH EXTRACTION AND TREATMENT.

EPA EXPECTS THAT THE AQUIFER WILL BE COMPLETELY REMEDIATED IN 20 TO 30 YEARS. THE PCE TREATMENT SYSTEM, TOGETHER WITH ACTIVITIES CONDUCTED IN OU1 AND OU3 AND OPERATION OF THE KLEIN WATER TREATMENT PLANT, WILL REDUCE TO ACCEPTABLE LEVELS, THREATS OF EXPOSURE POSED TO RESIDENTS AND THE ENVIRONMENT FROM CONTAMINATED GROUND WATER IN OU2. THE SELECTED ALTERNATIVE PROVIDES THE BEST PROTECTION TO HUMAN HEALTH WITHOUT SIGNIFICANT ADVERSE IMPACT TO THE ENVIRONMENT. REMEDIAL ACTION OBJECTIVES AND GOALS WILL BE MET. IMPLEMENTATION OF THE SELECTED REMEDY WILL NOT POSE UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS.

OPERABLE UNIT 3. DURING THE PERIOD OF TIME REQUIRED TO RESTORE THE OU2 ALLUVIAL AQUIFER TO ACCEPTABLE LEVELS, A POTENTIAL EXISTS FOR RESIDENTS TO BE EXPOSED TO CONTAMINATED GROUND WATER. THE REMEDY SELECTED FOR OPERABLE UNIT 3 ADDRESSES THIS EXPOSURE. ALTERNATIVE 2 PROVIDES PROTECTION TO HUMAN HEALTH BY ENSURING THAT RESIDENTS WITHIN THE CSC SITE ARE PROVIDED WITH WATER CONTAINING ACCEPTABLE LEVELS OF CONTAMINANTS, AS DEFINED IN TABLE 7. NO UNACCEPTABLE SHORT-TERM RISKS OR CROSS-MEDIA IMPACTS WOULD BE CAUSED BY IMPLEMENTING THIS REMEDY.

ATTAINMENT OF APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

ALL ARARS WOULD BE MET BY THE SELECTED REMEDY. ARARS FOR CSC OU2 WERE DISCUSSED IN SECTION VII OF THIS ROD.

COST EFFECTIVENESS

EPA BELIEVES THE SELECTED REMEDIES ARE COST-EFFECTIVE IN MITIGATING THE PRINCIPAL RISK POSED BY CONTAMINATED GROUND WATER WITHIN A REASONABLE PERIOD OF TIME. SECTION 300.430(F)(II)(D) OF THE NCP REQUIRES EPA TO EVALUATE COST-EFFECTIVENESS BY COMPARING ALL THE ALTERNATIVES WHICH MEET THE THRESHOLD CRITERIA, PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT, AGAINST THREE ADDITIONAL BALANCING CRITERIA: LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION OF TOXICITY, MOBILITY OR VOLUME THROUGH TREATMENT; AND SHORT-TERM EFFECTIVENESS. THE SELECTED REMEDIES MEET THESE CRITERIA AND PRODUCE THE BEST OVERALL EFFECTIVENESS IN PROPORTION TO THEIR COST. THE ESTIMATED COSTS FOR THE SELECTED REMEDIES ARE $2,420,000 FOR CSC OU2 AND $121,000 FOR CSC OU3.

UTILIZATION OF PERMANENT SOLUTIONS AND ALTERNATIVE TREATMENT TECHNOLOGIES OR RESOURCE RECOVERY TECHNOLOGIES TO THE MAXIMUM EXTENT PRACTICABLE

EPA BELIEVES THE SELECTED REMEDIES REPRESENT THE MAXIMUM EXTENT TO WHICH PERMANENT SOLUTIONS AND TREATMENT TECHNOLOGIES CAN BE UTILIZED IN A COST-EFFECTIVE MANNER FOR CSC OU2 AND CSC OU3. OF THOSE ALTERNATIVES THAT ARE PROTECTIVE OF HUMAN HEALTH AND THE ENVIRONMENT AND COMPLY WITH ARARS, EPA HAS DETERMINED THAT THE SELECTED REMEDIES PROVIDE THE BEST BALANCE OF TRADE-OFFS IN TERMS OF LONG-TERM EFFECTIVENESS AND PERMANENCE; REDUCTION IN TOXICITY, MOBILITY OR VOLUME ACHIEVED THROUGH TREATMENT; SHORT-TERM EFFECTIVENESS; IMPLEMENTABILITY; AND COST, AND ALSO CONSIDERING THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT AND CONSIDERING STATE AND COMMUNITY ACCEPTANCE.

OPERABLE UNIT 2. THE SELECTED ALTERNATIVE (ALTERNATIVE 2C) PROVIDES A PERMANENT, LONG-TERM REMEDY FOR THE PCE PLUME. ALTHOUGH ALTERNATIVE 5 WOULD RESTORE THE ALLUVIAL AQUIFER TO ACCEPTABLE LEVELS SLIGHTLY QUICKER THAN THE ALTERNATIVE 2C, THIS ALTERNATIVE POTENTIALLY IS ADMINISTRATIVELY INFEASIBLE, AND MAY RESULT IN MIGRATION OF THE CONTAMINATION ON THE WESTERN TIER OF THE RMA ONTO CSC OU2 AND THE DEPLETION OF A MAJOR SOURCE OF WATER TO THE RESIDENTS OF COMMERCE CITY. TOXICITY AND VOLUME OF CONTAMINANTS WILL BE REDUCED BY THE SELECTED ALTERNATIVE AS A RESULT OF OPERATING THE PCE TREATMENT SYSTEM AND THE KLEIN WATER TREATMENT PLANT. ALTERNATIVE 1 IS THE LEAST EFFECTIVE IN PROVIDING THIS REDUCTION. THE SELECTED ALTERNATIVE WILL NOT IMPACT THE CONTAMINATION ON THE WESTERN TIER OF THE ARSENAL OR DEPLETE THE AQUIFER, THUS PROVIDES THE GREATEST DEGREE OF SHORT-TERM EFFECTIVENESS. THE SELECTED ALTERNATIVE WAS THE LEAST COSTLY OF ALTERNATIVES MEETING THE THRESHOLD CRITERIA.

AIR STRIPPING WAS DETERMINED TO BE MOST THE MOST APPROPRIATE TREATMENT TECHNOLOGY BECAUSE IT IS THE MOST EFFECTIVE TREATMENT FOR CSC OU2 COCS, THE LEAST COSTLY AND EASIEST TO IMPLEMENT.

OPERABLE UNIT 3. THE SELECTED ALTERNATIVE (ALTERNATIVE 2) PROVIDES A PERMANENT REMEDY AT MINIMAL COSTS. NO ADDITIONAL ACTIVITIES WILL BE REQUIRED SUBSEQUENT TO CONNECTION OF RESIDENCES TO THE KLEIN WATER TREATMENT FACILITY. THE SELECTIVE REMEDY WAS THE LEAST COSTLY ALTERNATIVE.

THE STATE OF COLORADO CONCURS WITH SELECTION OF ALTERATIVE 2C (OU2) AND ALTERNATIVE 2 (OU3). APPENDIX C CONTAINS THE STATE'S LETTER OF CONCURRENCE WITH THESE RODS.

PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT

THE SELECTED REMEDIES SATISFY THE STATUTORY PREFERENCE FOR TREATMENT AS A PRINCIPAL ELEMENT. NO PRINCIPAL THREAT EXISTS FOR EITHER CSC OU2 OR CSC OU3.

#DSC
XI. DOCUMENTATION OF SIGNIFICANT CHANGES

THE PROPOSED PLANS FOR CSC OU2 AND CSC OU3 WERE RELEASED FOR PUBLIC COMMENT ON FEBRUARY 28, 1991. THE CSC OU2 PROPOSED PLAN IDENTIFIED ALTERNATIVE 2C, PCE PLUME TREATMENT/ HYDRAULIC CONTAINMENT OF PCE PLUME/AIR STRIPPING TREATMENT OF EXTRACTED WATER, AS THE PREFERRED ALTERNATIVE. THE CSC OU3 PROPOSED PLAN IDENTIFIED ALTERNATIVE 2, CONNECTION OF RESIDENCES TO SACWSD WATER SYSTEM, AS THE PREFERRED ALTERNATIVE. EPA REVIEWED ALL WRITTEN AND VERBAL COMMENTS SUBMITTED DURING THE PUBLIC COMMENT PERIOD. NO SIGNIFICANT CHANGES HAVE BEEN MADE TO THE CSC OU2 OR OU3 PREFERRED ALTERNATIVES, ALTERNATIVE 2C, AND ALTERNATIVE 2.

#TA

TABLE 6
CHEMICAL SALES COMPANY OU2 RA
CHRONIC HAZARD INDEX ESTIMATES-A - CASE 1

CHEMICAL	INGESTION	EXPOSURE ROUTE: INHALATION SHOWER	TOTAL
PCE	0.2	0.1	0.3
TCA	0.003	0.0008	0.004
DCA	0.003	0.004	0.007
DCE	0.03	0.03	0.06
1,2-DCE	0.03	0.03	0.06
COMBINED TOTAL	0.27	0.16	0.43

A - HAZARD INDEX CALCULATED BY DIVIDING EXPOSURE BY THE RFD.

CHEMICAL SALES COMPANY OU2 RA
EXCESS CANCER RISK ESTIMATES - CASE 1

CHEMICAL	INGESTION	EXPOSURE ROUTE: INHALATION SHOWER	TOTAL
PCE	3.6 X (10-5)	1.8 X (10-6)	3.8 X (10-5)
TCE	6.5 X (10-5)	8.8 X (10-6)	7.4 X (10-5)
DCA	1.5 X (10-5)	1.4 X (10-5)	2.9 X (10-5)
DCE	5.9 X (10-5)	1.2 X (10-4)	1.8 X (10-4)
VINYL CHLORIDE	8.5 X (10-5)	1.3 X (10-5)	9.8 X (10-5)
BENZENE	7.1 X (10-7)	7.5 X (10-7)	1.5 X (10-6)
COMBINED TOTAL	2.0 X (10-4)	1.6 X (10-4)	3.6 X (10-6)

TABLE 7
CHEMICAL SALES COMPANY OU2 RA
CHRONIC HAZARD INDEX ESTIMATES- A - CASE 2

CHEMICAL	EXPOSURE ROUTE: INGESTION	INHALATION SHOWER	TOTAL
PCE	0.002	0.002	0.004
TCA	0.001	0.0003	0.004
DCA	0.0002	0.0002	0.0004
DCE	0.0001	0.0001	0.0002
1,2-DCA	0.0007	0.0007	0.001
COMBINED TOTAL	0.004	0.004	0.008

A - HAZARD INDEX CALCULATED BY DIVIDING EXPOSURE BY THE RFD.

CHEMICAL SALES COMPANY OU2 RA
EXCESS CANCER RISK ESTIMATES - CASE 2

CHEMICAL	EXPOSURE ROUTE: INGESTION	INHALATION SHOWER	TOTAL
PCE	5.5 X (10-7)	2.8 X (10-8)	5.8 X (10-7)
TCE	4.2 X (10-7)	5.7 X (10-7)	9.9 X (10-7)
DCA	6.6 X (10-7)	6.6 X (10-7)	1.3 X (10-6)
DCE	2.2 X (10-7)	4.4 X (10-7)	6.6 X (10-7)
VINYL CHLORIDE	1.4 X (10-5)	2.2 X (10-6)	1.6 X (10-5)
BENZENE	3.6 X (10-7)	3.7 X (10-7)	7.3 X (10-7)
COMBINED TOTAL	1.6 X (10-5)	4.3 X (10-6)	2.0 X (10-5)

TABLE 8
REMEDIATION LEVELS FOR CSC OU2

CHEMICAL	REMEDIATION LEVEL (UG/L)	ANALYTICAL METHOD	ANALYTICAL DETECTION LIMIT (UG/L)	COMMENTS
DCA	5	RAS	5	(10-6) RISK LEVEL
1,1-DCE	7	RAS	5	MCL (40 CFR 141)
TCA	200	RAS	5	MCL (40 CFR 141)
PCE	5	RAS	5	MCL (56 FR, NO.20, 1/30/91)
TCE	5	RAS	5	MCL (40 CFR 141)
1,2-DCE	70	RAS	5	COLORADO BASIC STANDARD FOR GROUND WATER, EFFECTIVE 9/30/89
	(CIS AND TRANS)			
BENZENE	5	RAS	5	MCL (40 CFR 141)
VINYL CHLORIDE	2	SAS	2	MCL (40 CFR 141)